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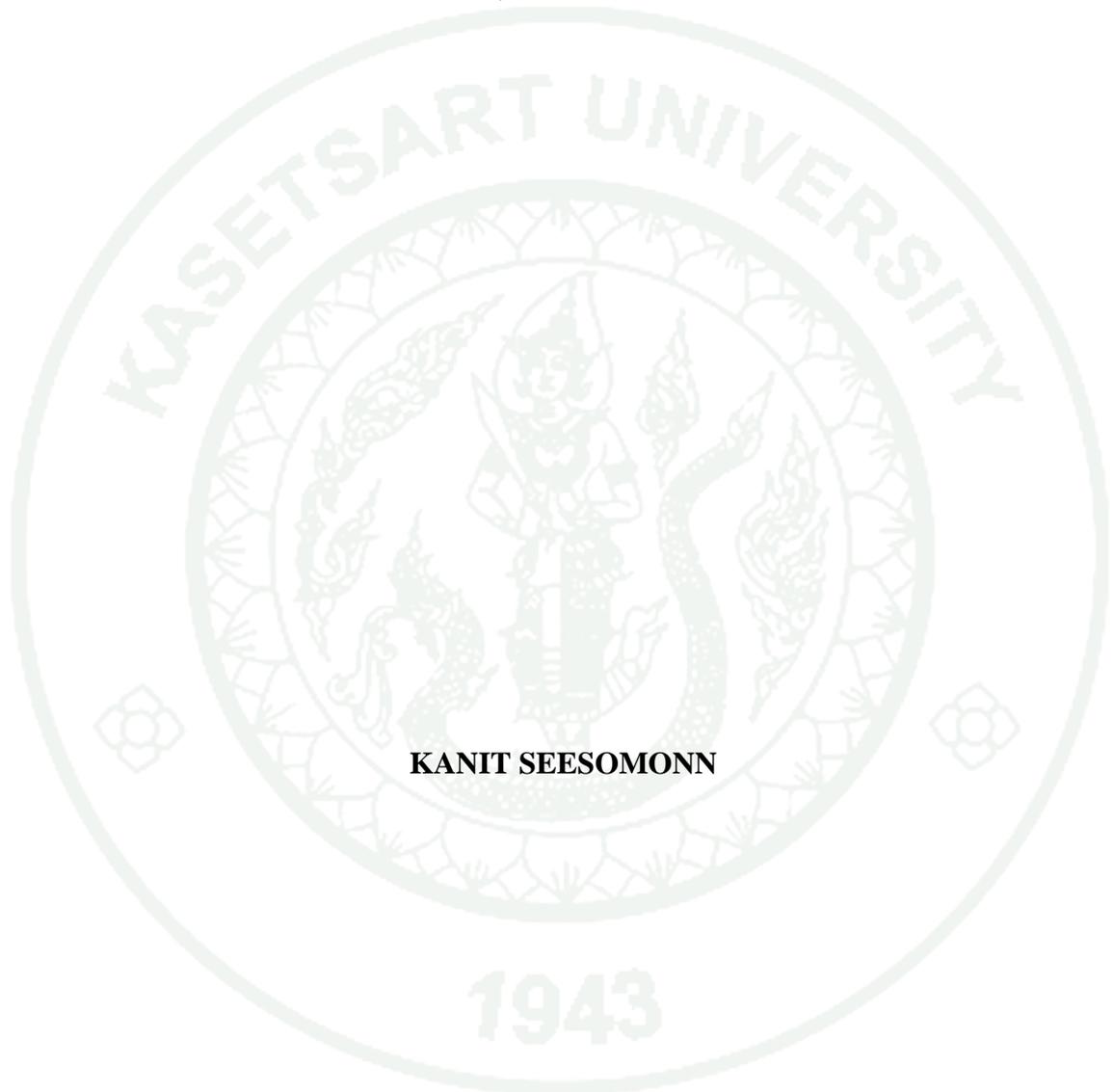
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THESIS

**PARTICIPATORY WATERSHED MANAGEMENT PROCESS:
A CASE STUDY OF HUAI MAE DI NOI WATERSHED,
BAN RAI DISTRICT, UTHAI THANI PROVINCE**



KANIT SEESOMONN

**A Thesis Submitted in Partial Fulfillment of
the Requirements for the Degree of
Doctor of Philosophy (Forestry)
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Kanit Seesomonn 2010: Participatory Watershed Management Process: A Case Study of Huai Mae Di Noi Watershed, Ban Rai District, Uthai Thani Province. Doctor of Philosophy (Forestry), Major Field: Forestry, Interdisciplinary Graduate Program. Thesis Advisor: Mr. Pearmsak Makarabhirom, D.Agr. 111 pages.

The study on participatory watershed management process was conducted in Huai Mae Di Noi, one of the highest value watershed of the western Thailand. The objectives of this study were 1) to analyse status and problems occurred in the watershed, 2) to analyse alternatives to watershed management and 3) to establish watershed management process through people's participation. Participatory Action Research (PAR) was employed to collect and analyse data and information gathered through a cycle of conceptualizing, planning, acting, concluding lesson learned, and suggestion for the new learning cycle. Huai Mae Di Noi was a rich forest watershed, with an area of 95,000 rai, of which 10% of its area was under agriculture. The watershed consisted of 5 Karen communities with total population of 246 households or 1,213 persons.

The study revealed that there were 29 positive indicators. The dominant cases were the abundance of natural forest resources and the community living in harmony with the forest. The negative indicators were 27 cases, with strong cases on inappropriate land holding and introduction of inappropriate culture from outside. There were 46 groups of community member organized and participated in the watershed management processes. The most effective approach to tackle watershed problems was the participatory processes through deep dialogues with individuals and groups and help them organizing informal community groups to manage forest and natural resources in a participatory way. The watershed management policy should incorporate the watershed analysis, community organization, plan and action with full participation of local communities.

Student's signature

Thesis Advisor's signature

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PARTICIPATORY WATERSHED MANAGEMENT PROCESS : A CASE STUDY OF HUAI MAE DI NOI WATERSHED, BAN RAI DISTRICT, UTHAI THANI PROVINCE

INTRODUCTION

Watershed management deals with several kinds of resources including soil, water, forest, human resource and integrated knowledge in management. Impact of mismanagement consequently causes many problems such as deforestation, degradation of water quality, soil erosion and soil nutrients loss etc, resulting in degrading living conditions of mankind, therefore, proper management of watershed is important for mankind and badly required. Three principles in watershed management are well recognized that are landuse planning, optimizing natural resource utilization and pollution control.

Over the past decades, the process in watershed management was dominated by the government agencies, for instance, Mae Sa Watershed Integrated and Forest Landuse Project in Chiang Mai, Mae Chaem Watershed Development Project in Chiang Mai, and Nam Phong Watershed Development Project in Khon Kaen. After closing these projects with successful stories, these watersheds currently have still had many problems, decreasing in forest area and conflicts in resource management between the government and local communities. The problems are still far from being solved. Many research results have been kept in the shelf rather than applied in the field.

Problems in watersheds have dynamic with direct and indirect impacts to society. Therefore, solving problem in managing natural resource in the watershed through community participation has been highly recognized, particularly in solving forest and resource uses. Participatory approaches such as community forestry and forest community networks have been widely used. Empowering local community has been identified as suitable way to handle problems.

Conflict over the conceptual thinking and the implementation methods between local communities and the government is one of the major obstacles in watershed management even though both groups have the same targets that are happiness in living condition or the balance of the system. Establishment of a new method by using local knowledge-base and acquiring new knowledge can solve the problems in watershed management. The process of participation in many related groups is an alternative way that can contribute the power of communities in watershed management.

The study on people's participation in watershed management process is a new method to search for alternatives to watershed management that recognizes the importance of community participation. This idea bases on the fact that people in local community live nearest, therefore, well understand the resources than the outsider. In addition, they have hand on knowledge and experience in those particular areas. Although their knowledge and experiences have not been properly documented, but what we have observed over years are best evident of traditional best practice of resources management. However, in building up traditional practice into proper current practice, new data and knowledge are required. Participatory action research can help bringing in various groups of people involved such as villagers, researchers, technical government officers, local authorities to learn together.

Huai Mae Di Noi Watershed, Ban Rai District, Uthai Thani Province is selected to test people's participation approach in watershed management for four reasons. First, the watershed area has high biodiversity in the site of Huai Kha Khaeng wildlife sanctuary buffer zone and some areas within the wildlife sanctuary. Second, Karen who lives there and practice agriculture in place has different traditions and culture for natural resources management from the people in the plains. Third, this area is a watershed that has communities directly upstream from Huai Kha Khaeng wildlife sanctuary (one of the world natural heritage sites in Thailand). Fourth, this watershed has had conflicts between the community and government officials over a long time. Particularly, conflict between forest officers keeping forest area and Karen people who are practicing agriculture. The methods to solve problems are not mutually accepted.

A thorough study of the truth of problems and processes of watershed management by community participation and with serious consideration of ecosystem and culture is the challenge and is badly needed for this protected area buffer zone.

OBJECTIVES

The objectives of this study are as follows:

1. To analyze the status and problems of community and natural resource in Huai Mae Di Noi Watershed.
2. To analyze alternatives to watershed management in the Huai Mae Di Noi Watershed,.
3. To establish management process in the Huai Mae Di Noi Watershed, Ban Rai District, Uthai Thani Province with local people participation.

Scope of study

The scope of this study was based on the three principles of watershed management i.e. land use planning, natural resource utilization in conservation and pollution control. With active participation of 5 communities: Ban Tai, Ban Khlong Salao, Ban Mai Khlong Ungwa 1, Ban Mai Khlong Ungwa 2 and Ban Yang Daeng (Chao Wad) Huai Mae Di Noi Watershed, Ban Rai District, Uthai Thani Province as well as government officers in the research areas. They were involved in the analysis of situation and problems of the watershed, establish a participatory solution development process, analyze alternatives, test alternatives, plan participatory watershed management and develop a policy guideline for participatory watershed management.

Definitions

Definitions of keywords used in this study:

Process: continuous practices from start to end in the participatory action research: A case study of watershed management in Huai Mae Di Noi Watershed, Ban Rai District, Uthai Thani Province.

Management: the practice of activities such as protection, utilization, restoration of natural resources in the area and community for the balance of ecosystem and livelihood of community.

Watershed: the unit area of land will get the rainstorm which related to water management with no specific size and depend upon the watershed manager's objectives.

Watershed management: the sustainable utilization of integrated natural resources and environment by the stakeholder participation under both the principle of watershed and environmental management and the principle of natural resources conservation within the drainage basin area to protect, maintain and improve the water quantity, quality and timing including erosion, waste and pollution management from any human activities in the watershed areas.

Participation: the processes and activities in which people in the community, government officials and researchers collaboratively work to meet the common objectives in balance of watershed system based on social, economic and environmental indicators.

Watershed management process: the continuous practice of the natural resource, social and economics of community.

Participatory watershed management: the collaborative work of people in the community, officials and researchers to meet the watershed management objectives.

Participatory action research: the learning processes to create new knowledge and actions to solve the problems of the watershed through collaboration of relevant persons, group and organization.

Buffer zone: the area within 5 kilometers of the boundary of Huai Kha Khaeng Wildlife Sanctuary; consisting of natural forest area, agricultural area community and other areas that people can use for their practices under control of laws.

Community: a group of people that are bound and related by the same traditions and culture, and they have clear grouping and position of households.

Rotational cultivation area: an area where Karen uses to grow rice and other crops necessary for family consumption. In doing cultivation, the land is divided into several plots, i.e., 5-8 plots, and each plot will be used for cultivation for 1-2 years and move to the other plot until year by year until the last plot. The used plot was left naturally waiting for the new cultivation cycle to come.

LITERATURE REVIEW

This study involves various concepts such as : watershed management and natural resources management, community based watershed resources management, sustainable development, participation process, participatory action research, conflict theory management and life of Karen in Uthai Thani province.

1. A concept in watershed management and natural resources management

1.1 Principles and theory in watershed management

The research in watershed management of Thailand has taken place for half century, through technical assistance from western countries. This constraints the use of local culture and knowledge in managing watershed. Academic documents being used are mostly in the same concept as seen in Chunkao (1996), Tangtham (1984), Niyom (1992), Boonyawat (1996), Hewlett and Nutter (1969), Dingman (1994) and Chunkao (1997) etc. The holistic approach in watershed management which include human and social dimensions has been lacking behind. This has been confirmed by the absent of social paper on research report of the Watershed Research Subdivision (1997).

This study uses the holistic view on concept and theory in watershed management by integrating human, social and culture dimension such as, watershed management based on culture and custom, local knowledge and the role of the local community with scientific dimension in watershed management. This lay down on the concept that villagers have wisdom in resources management as many persons do. For example, Natural Park, Wildlife and Plant Conservation Department (2004) mentioned in a Royal Address given at the closing ceremony of the northern agricultural seminar Northern Agricultural Office, Chiang Mai on Thursday, February 26, 1981, in some essence “the people are clever, those on the hills as well as on the plains. They are knowledgeable; they have worked for generations; they have earned their livelihood; they are intelligent; they know where to cultivate and to conserve and keep intact. The country people or the hill people have proper knowledge. Only after some simple explanation, they understand.” Suwannarat *et al.* (1986) said that people knew conservation a long time ago; they used straw, rice stem or dry grass to cover soil to reduce evapotranspiration when growing plants, and cultivated banana or other kinds of plant around ponds as windbreaks, which similarly reduce evapotranspiration. Watershed management in the great majority of projects was implemented by government. Masathian (2001) concluded that watershed management projects in Thailand such as Mae Sa Watershed Integrated and Forest Landuse Project, Mae Cham Watershed Development Project in Chiang Mai province and Nam Phong Watershed Development Project in Khon Kaen province, the role and importance of community resource management based on culture, local knowledge, community participation were lacking in every project and the results were not clear.

From the above reasons, many groups give priority to social aspects in watershed management such as community participation, cultural-based resource management, and local knowledge in resource management. The watershed systems should develop in balancing acts among various social and scientific aspects rather than the sole scientific management.

1.2 Natural resources and environment management

Sustainable utilization of natural resources requires management in a holistic and integrated system and this has been mentioned by Chunkao (1981), Ruangpanich (1985), Chunkao (1997) etc. Every unit in resource management must collaborate (Thearnnoi, 1996). In varieties of resources; forest is essential for life and in this case Sukwong (2000a) said the value of forest cover has three values: economic, social and environmental. Forest is an important resource that helps balancing the three values. The management to cope with globalization is challenging. In practice, every action relates with communities has been lacking of public interest. From the above reasons, resource management is not particularly person or group implement. Para (1999) said that everyone should know and realize about environmental problems and coordinate to restore it. The lack of proper support resulted in natural resource management problems in Thailand such as out obsolete institution, lacking environmental information and weak law enforcement.

1.3 Watershed classification

Watershed classification is being used as a tool to watershed management. Watershed classification divides areas and guidelines in natural resource use based on principles of conservation and efficient environmental management. Many environmental problems in the past were caused from natural resource and environment utilization not being in clear zones, so the measure of land use in watershed class is one of the methods for solving environmental problems.

Thailand's watershed area was divided into 5 classes i.e., high-value protected area, protected area or economic area, steep slope of hillside area, plain area, and area of plain to paddy area, and managed areas according to the watershed classes. This help better land use planning, however, due to lacking of some important factors such as geographic factors, cultural or social management, the implementation of watershed measures in many areas are unsuccessful. The factor of human resource or social factor is necessary to use in the management process.

Huai Mae Di Noi watershed covers from the 1st to the 4th watershed classes with the majority of the area in the first class. The fact is that in every watershed class, some areas have been used for agriculture by Karen for generations. They lived in the area before the project was implemented and the plain area is used less for agriculture; they have worked for generations in their own customs and culture. The measure of watershed classification cannot succeed entirely when applying in this watershed and is a cause of conflict from the past to present.

1.4 Community watershed management

Various parts of watersheds, from the high mountain to the sea, in Thailand have long been managed by communities. The best practice case in Tapa, Songkhla province, revealed that local knowledge has been used in managing watershed area. Their traditional way of protecting watershed using cultural insight, belief, pay respect to relatives, worship to sacred things and coordination of people to manage forest, is part of conserving plants, animal, and culture, resulting in sharing knowledge between local people and urban people. The community has knowledge in landuse planning, and land zoning with respect of cultural dimension. The networks of communities in Thapa watershed are established and working processes have been initiated to manage soil resources, water resources, forest resources, human resources and others which,

particularly in the part of spirit dimension, would balance social, economic and environment aspects.

In the year 2003, many communities have won good performance award in community-based natural resources and environmental management. Among them are Banpang community, Tambon Banpang, Thong Hua Chang district, Lamphun province; Mae Tachang watershed community network, Mueang and Mae Rim district, Chiang Mai province; Sa-Khoo conservation group in Na Yong district, Trang province and Huai Luang low area community (one stream in Khlong River) in Nong Khai and Udon Thani provinces. In 4 cases it was found that every community used participatory process and networking as well as appropriate technique and integrated knowledge to manage soil, water, forest resources and environment. In overall, watershed and resource management, therefore, require integration of scientific and social knowledges because they are both a crucial part and have linked in the system.

2. Paradigms of community based watershed resources management

2.1 Community and Resource management

Community is a group of people who coexist in a small social group, reside in the same area and have co-benefit (The Royal Institute, 1996). Kanchanapan (2001) said that community covers administration, development, culture and knowledge; it originates from social unit and administration institute to relation process characteristic and various concepts such as community organization, forest community, community culture, rights and community authority.

Being a community, it is necessary for people to grouping for determining an approach to proceed in life for happiness in society and sustainability, and justice everywhere in resource management but the damage of it comes from officials using authority of government representatives instead of the practice that people in the community have used, and they are not necessarily thinking and doing for collective social benefit (Community Forestry Division, n.d.).

Local knowledge is a crucial factor that has an impact on either success or failure of the community. Once knowledge in agriculture is appearing in agricultural institutes, local knowledge which has been tested over a long time in the condition of the ecology where they live has been lacking behind (Buroosbhat, 1970 and Lieamchumroon, 1992). Na thalang (2001) said that the local community learning process and local knowledge development are the results from learning in the nature and adjusting to suit their livelihood. New knowledge from outside cannot replace original local knowledge but it is suitable when applied to use in this status. Local knowledge is an accumulation of experience over a long time passing many of the processes to the present in custom and culture and passing on worship for their livelihood. The local learning processes are different from education in school in this time.

The dimension of community in the National Economic and Social Development Plan in remote areas comes to a standstill and lags behind. Policy to promote extensive agriculture caused problems between government and community especially for landuse where people encroached on new forest land, while at the same time government requires to increase forest area by establishing new law. The technician has had to give

importance to community power since the year 1977 when landuse problems and forest protection started the environmentalism process (Chiengthong, 2000). In case of communities potential, community study in itself on authority and ability under control and fight with external power were realized. This is base on the believes that participatory decision process by majority of peoples who closely practice in area contributed to the right decision with respect to their problems and needs and the mechanism to resolve the conflicts.

Local tradition and beliefs, recognize both the individual ownership and the community ownership (Nakabootra, 1993). Research and Development Institute (1993) reported that natural resource and environment problem-solving in the past used the role of government that showed in policy which it did not care to local community and community organization. The policy in natural resource management before the Constitution of the Kingdom of Thailand in the year of 1997 was determined by academics, government officials, politicians, merchants and businessmen on some persons and separate for management, in protected area where to go without peoples (Klinkajorn, 2001). Makarabhirom (2000) said that quality of life in the local community depended on various elements such as having confidence in their household and practice on their occupation. In truth status methods for to it are lacking according in the paragraph forest are not destroyed because poor live in forest but peoples who live in forest are poor because degenerate in forest that appear in conclusion of world forest problem meeting, in the case means on developing country when forest was damage causes of it are local peoples who live in forest or communities that was to lend a hand forest resource, in opinion do not analyze real cause which in forest management must to status of them and culture, community economic and local administration (Makarabhirom, 2000). Wittayapak (1995) said that in the forest management development process in sharing of rights, we must consider the community institute in that numbers in the community were established to control the community resource utilization behavior.

2.2 Characteristics of community resource management

Community resource management has diversity, i.e., forest management, traditional irrigation system and soil management. The community forestry form is popular and clear in its wide vision; kinds of community forestry are natural forest conserved by a community and tree planting that is managed by a community. Korwanich (1984) determined that community forestry is natural forest or manmade forest for community utilization where people participate in growing tree; forest village, woodlots, planting trees in paddy fields or small tree planting for sale or for home industry. In this case Jamarik and Tantasombat (1993) said that the important concept of community forestry is not whether it is plantation or forest rehabilitation intension but human and the relation with people or community and the environment are a conceptual part of it. The concept is the same as local development strategy which necessarily analyzes an overview of the problem in local development for every part. Sukwong (1995) said community forestry is a forest that people control, manage and use; and it is managed so everyone has right to utilize wood from forest. Pragthong (1990) said that the concept of community forestry in Thailand was implemented long time ago, and people use forest for their livelihood, and the pattern of utilization based on topographic, ecology, economic and social aspects are different in each area. Community forest developments are based on 4 ideas: concept in ecology that human are part of the ecosystem, concept in local development that forest action impacts on local community development, concept in authority distribution that distributes authority in

forest management from government to community by participatory process, and concept in utilization that forest resources can increasing given suitable management.

Korwanich (1985) said that forest utilization as a principle in social development must be clear in basic needs of local peoples; their livelihoods are related to forest but in practice without planning and measure it can cause imbalance of nature. Forest management by a community is based on various factors and the community must follow the same pattern as stated by Jamarik and Tantasombat (1993) who said that communities who conserve forest have the same 8 characteristics: strange community, sufficient forest area for utilization or rehabilitation to return biodiversity, co-benefit, common sense in forest protection, good leaders, community organization, customs in resource management and resource management justice system.

2.3 Form of community resource management in other countries

Community forest movement has been active in many countries in the region. (Makarabhirom, 2001). Some selected examples are that, In India, joint forest management project has been implemented by cooperation between the state and the people. The people are empowered to manage production forest for their own uses and pay tax to the government according to the uses. The benefit ratio between the state government and the people is 1 to 3.. In Nepal, the state handed over the forest adjacent to community to the people to manage them without taxing. This resulted in formulating thousand of forest user groups to manage community forest for their needs. Revenues the each village received from forest users have raised village development fund and use it for rural development activities. In China, the state transferred authority in forest management to people or business groups for management in the form of promised obligation. In Vietnam, the state has a plan to rehabilitate forest and resources that were destroyed with economic development in the form of contract. In Lao PDR, from the year 1999 agricultural and forest officers moved their offices from central locations to the country with the objective to stimulate people to manage forest for their livelihoods and find out the interest for establishing community development funds. In the Philippines, the state transferred indigenous rights to settlement and manage natural resource to the tribes, and have a project to transfer authority from the center to the community. Teerakanon (2003) said about the tourism in protected areas of Thailand are implemented by officers that control that area while the management of protected areas in other countries particularly in Chittawan Natural Park in Nepal, empowered local community to restore forest in the buffer zone area and allow people to organize ecotourism and forest manage. The benefit obtained from this activity is sent to forest rehabilitation and village development funds. In Papua New Guinea, local non-government organizations and international conservation organizations joined with local communities to set up the local research center where local people are technicians and guides. In Carkakarmue-Cunimaipa Wetland in Indonesia, the conservation organization joined with Korlindu Natural Park to increase community interest, develop people's interests and to collaborate in doing practices. In the Solomon Islands, a conservation organization joined with the government and local community for zoning in Aranaworn Island in a marine resource conservation area. In conclusion, in the four cases, the governments gave roles to community participation and establish laws to support their practices.

3. Sustainable development

Sustainable development aims to meet the development goal on the ground. Tanthanasarit (2001) said that sustainable development in specific paradigms is in the proportion and direction of the balance in environment, social and economic forms from development. The development that copies western countries who have different economics, society, politics and culture causes three kinds of problems: gap between poor and city dwellers problem, under central control and various external conditions problem and environmental damage (Jamarik and Tantasombat, 1993). Eawsriwong (2000) said that to reform resource utilization for social justice to solve poverty must consider how sustainable Thai peoples relate to forest. Sunyawiwat (1997) determined that the meaning of social development is social structure changing from determining needs, with 2 kinds of changes being natural changing (non-formal in changing) where human cannot determine the change or have little influence, and planning to change whereby people determine what they want to change. In this case there is the condition to understand about the direction and strategy in development and soil water forest in form or government management. Nakaboottra (1993) said about direction and strategy next are 2 levels: strategy in macro that distributes the owner in soil water and forest to cooperate use in traditional and community participatory management, and strategy in micro (community level, network level, for example, watershed network, forestry community network). Variety in owners of natural resource instead of monopolizing management by government; variety in laws and traditions in each local community; variety in natural resource management mechanisms in various cultures and integration of knowledge linked to topography, science, community, economics and community culture are sustainable in ecosystem and community culture guarantee that everyone's needs are met.

Developments are essential to use in the process of administration. Joonnapiya (1997) said administration for development has an impact from environment and environment may also receive impact from administration development. The R.H.M. King Bhumibhon uses administration development principles in Royal Projects when he goes to every region in the country to see his people so he knows their worries and he thinks to solve problems according to the status of the area and the social psychology characteristics in the community. The first principle that the King uses in problem solving in the country is development based on real problems and the environment in each area; he uses the enthusiasm of local people in looking at their problems and needs.

For sustainable development in grassroots policy approach, the Ministry of Agriculture and Cooperatives are the main office to implement the policy into success. The strategies of the Ministry are better livelihood of farmers and increasing income. The prime minister announced 6 years ago that there will not be poor in Thailand and he stated his policies to help his announcement become successful, such as farmers having enough land, changing property into capital, solving droughts etc. The method is grassroots farmers solve problems and indicators of the announcement are increasing knowledge of farmers, livelihood and products. All of the indicators are pointing towards Thailand without the poor because the farmer population is about 35 million persons so if this group is without poor then Thailand is a country that is not poor also (Thairath, 2004). However, sustainable development happens if it develops from minds following Buddhism. Prayootto (2000) said that the sustainable development process has 2 steps: human development in 3 parts; involve behavior, spirit and wisdom, and sustainable development by using human that pass the development process in the center of development. Inthongpan (2002) concluded

that everything in nature has value in itself and how human have traditions they do with nature the same as their body as in the physical nature of human are elements of nature compounds of soil, water, wind and fire elements. If human cause pollution in nature it means human destroy themselves and to live sustainably it is necessary for human to conserve nature while renewing nature that is wasted.

Sustainable development requires clear understanding of situation, problems and their cause before hand. The development pattern adopted from western countries may cause many problems such as poverty and damage of resources, etc. The country development specifics are essential for sustainability in Thailand and in process must be clear in status. In the condition of the majority of people who live in the country, if the majority was developed in the specifics that means Thailand is a sustainable development country.

4. Process of participation

Participation has been defined by many researchers. Joongwootteewat (1984) said that participation means the relation in mind and humour of one person in one situation. Hongwiwat (1984) determined the meaning of participation as the action that peoples or community develop of their ability in management utilization control and distribute resources to livelihoods on an economic and social basis as essential and suitable in social numbers. But Dacharin (1984) said that the meaning of participatory community policy development is a process of government intention to conduct, support and give chance to people in a community in the form of person, group, club, society, foundation and volunteer organization to join in one or more implementation. Jamarik (1984) said that community participation did not mean that people participate following what the technician or development organization require but as the communities really practice in themselves. Singsureeya (2002) concluded the meaning of participatory as people in a community participate in thinking, decisions, planning and doing that carry on in the direction of changing to respond to their needs. Sukwong (1989) divided steps of participation in forestry community management into 4 steps: participate in decisions, participate in doing, participate in dividing interest and dividing to evaluate. Throngwattana and Kumnoi (2000) concluded steps in community participation as 14 steps: good relation in community, survey general data, community study, training people in the community, grouping for joint action, supporting in action relations, group learning, training officer leader of community and people, making interest, supporting in essential action, supporting to community law, supporting to watershed network organization, evaluation, using law and in the last method, officer linked to the community are sincere and sacrifice of leader in process of participation.

Forest management under the laws in the past was caused conflict between peoples and government. The new dimension in management uses participatory process of people organization and related offices (Doklamyai, 2001). Pragthong (1994) said about techniques and processes working with people in development are techniques and the learning process to working with people in linkman state, techniques in forestry community surveying and techniques in managing administration.

We can improve on the resource management process by using participation of everyone who is related to the resources (Regional Community Forest Training Center for Asia and Pacific, 2002). Andrew and Sukwong (2002) similarly said that resource

management implemented by many persons and groups are challenging practices in that the process needs balance towards the target and methods have to be checked for suitability.

Sukwong (2000b) said that one factor in the successful forest rehabilitation process in accordance with ecosystems is local community participation. Sukwong (1995) said that people's participation in community forestry management does not mean particularly in the action of forest protection but in covering sustainable utilization by local peoples.

In conclusion, participation is peoples in a community and related persons join in activities based on the work in each action following their ability in each person from thinking, planning, doing, receiving and evaluating. All of the processes have social benefit, and the target is a balance of the system that can be monitored.

5. The Participatory Action Research

Participatory action research (PAR) is the process to search for the knowledge as well as to solve the problem through action with participation of community. PAR aims to build up a problem solving process in community. The success of PAR is not getting what we want but what they can use for development of community potential. Therefore, PAR help community to solve without waiting technical knowledge from outsiders. (Keawsong, 2001)

Makarabhirom (2002) said that action research is the principle and method used to study and find out knowledge with 2 main objectives: the research and the action, with some significant features i.e., dynamic process, flexible, and repetition as cycle. Participatory action research requires understanding of principle and planning processes. Gatwong (1998) said about principle and planning techniques that planning is a projected decision making to work in the future.

Northeast Community Institute (2002) reported that participatory research is the joint decisions of researchers and people and conform with the people-centered development concept. Participation has 3 forms: participatory observation, participatory research and participatory action research. The first one is the method used for study in the field or observation in the field, consisting of observing human behavior, group behavior and community behavior, documenting dialogues. The researcher usually lives with people in community. The second one is participatory research in which researcher and peoples collaboratively collect data. In the method, researcher's role has to be minimized and allow local researcher's role to do more. The third one is participatory action research. This method has the research techniques similar to the first two methods but more active participation from the people. This research based on experience of every related person through a process of finding out problems, problem solving, implementation, checking and evaluation.

6. Concept and theory of conflict

Conflict is a situation of disagreement (The Royal Institute, 1995). Kunurat (1995) said conflict is to struggle and fight between 2 sections that feel different in their targets and cannot get along with each other. Conflict is a common social phenomenon. Kongdee and Laohasririwongsa (1986) said that conflict is a response or status that people or more

than 2 groups of people cannot relate in value judgment, thinking, culture, hopes, working process and results of work. Emphandhu (1998) determined the meaning of conflict as the difference in one story of thinking, altitude, belief or behavior or things that both are interested in causing strong feelings and the reaction to fight against. For Pechpood (2000) the meaning of conflict was status that a person or group of persons do not understand each section so feel uncomfortable in the mind when living or acting with another person, and he said that the characteristic of conflict has 2 persons with different values or targets they attempt to make other sections lose or reduce importance to fight against if confronted and making unbalance when meeting.

Conflict is a cause of organizations breaking; the good organization can avoid conflict when it happens. Misadministration is a cause of conflict but it can support an action in an organization, thence, administration should be for best results that are useful, not based on the method of administration. The good organization has conflict in suit level that is stimulating and attracts persons to be efficient in working; conflict is one part of an organization system cycle that helps persons attempt and stimulates them to find out methods in problem solving (Wisalaporn, 1991). Conflict is a common phenomenon and when it happens to everyone or every group they must be sincere in solving it by using mechanisms in solving from knowledge and experience in resource management of various sections in the participatory process (Andru and Sukwong, 2002). Panyarachoon (2000) said that he was anxious about conflict and methods in fighting on forest resource management and utilization especially conflict between government with people and between businesses with people; the conflict in the society of Thailand is based on different truths that are the factors in the fighting of government and people. Sukwong (2000c) said that from the cause that without laws in Thailand to recognize community rights in forest utilization and determination for response in forest management, the poor in local communities cannot go into the forest resource with happiness.

In forests, the areas that poor peoples have ever-encroached, now transformed areas that are required by many kinds of persons and the conflicts are in 4 types: conflict between government and community, conflict between community and economic authorities, conflict between nearby communities and conflict within the community (Jamarik and Tantasombat, 1993). Community networking was established from grouping of communities with conflict in utilization of forest resource management and landuse. They want to improve government policy for local communities in conjunction with resource protection and justice in the mechanisms of specific practices. (Klinkhajorn, 2001)

Conflict is caused by three factors: personal causes, social causes and physical causes (Pechpood, 2000). Specific characteristics that show in the condition of conflicts have 5 forms: unhappy, some event, misunderstanding, stress and critical in event (Emphandhu, 1998). Conflicts are a cause of many problems and various kinds of loss. Nakaboottra (1993) said that confrontation and scramble in natural resources cause loss in 3 parts: the gap appears between local peoples with officers or government authorities, government and local communities confront so they do not participate to solve a critical event, and peoples whose livelihood depends on natural resources are put under pressure of shifting life and hopelessness. Conflicts of community level and macro level cause them to snatch away natural resources because the laws used in the country were established by government. The approach in one dimension lacks the dimension of community culture that their livelihood has used natural resources for generations.

For the balance of the systems there must be administration to manage conflicts. Poonyanuparp (1996) summarized Triphidaka number 7 named Joonlavaka as a group of 3 to deal with conflict in monk groups. One paragraph of it said the Buddha admired Pra Sareeboottra as he had the good characteristics of an emissary because he had 8 qualifications: listening to others, making others listen to him, wisdom, good memory, understanding others words, making others understand his words, genius in usefulness and not being the cause of disputes. If we are clear in the teaching it is the best management in conflict solving.

Wireeyasakunthonna (1995) said that conflict solution uses integration of knowledge in research and action, psychology, economics, communication and study in peace. Solution in the form of the original community is the method that is most successful because the action was strengthening local institutes or making the new local institute. Phetpood (2000) divided the alternatives in conflict solution into 3 methods. The win:lose method is not good because persons who lose will reject their loss and not relate to the winner so attempt to unbalance the system by making an influence group for controlling the losing group. The lose:lose method is the method that avoids confrontation by solving it temporarily and may use compromise. The win:win method is what every person wants, and forms of this method find out agreement by the participation process that uses real data and considers every person's needs.

Conflict solving consists of six methods as follows: by traditions and informal talk, gathering people and driving movement, building local people's network, cooperate with the government for making fair judgment, to bargain with government to recognize community rights in resource management and relating with every office. All of the methods show that people are interested in problem solving both long-term and short-term and they can relate with others groups (Jamarik and Tantasombat, 1993). Existing in social people organizations about fighting in the case of natural resource struggle are 3 levels: existing on peaceful means and culture, research process to use in the fight and relations with technicians, political and government officers for policy and national plan improvement (Nakaboottra, 1993).

In conclusion, conflict is the event without understanding between persons or groups of people at the spiritual level and physical level that destroys in each case but this behavior is common to world nature. To avoid disturbance when conflict is happened, good management can solve it. Causes of conflict are from inside and outside of people or communities. Internal conflicts are confusion in the minds of each person that has special importance because it is the origin of other's conflict. An approach in conflict management is necessary to integrate knowledge and the best methods by following the teaching of every religion.

7. Karen in Uthai Thani province

7.1 General data of Karen

The tribe of the Karen was originally in Tibet-Burma group. They immigrated from the north to southern regions (Yong, 1961 and Buroochbhut, 1975). Karen is the largest of the hill tribes in Thailand (Department of Public Welfare, 1995). National Research Council (1992) grouped Karen into 4 groups: Skoaw Karen or Yang khao, Po Karen or Yang Daeng, Baway Karen and Tongsu Karen.

Each group of Karen has firm beliefs and religion; they are similar in worship and the majority respect spirits, believing that spirits live in everything and human are one part of nature and we nature should be respected (Leungaramsri, 1991).

7.2 Karen in Uthai Thani Province

Uthai Thani Hill Tribe Assistance and Develop Center (2001) reported that Karen in Uthai Thani Province have their origin in Thaway City of Myanma. They came to settle down at highlands and plains in the western province of Thailand. Generally, the Karen use Karen and Thai language for their communication but Mon language in worship, belief in Buddhism, Brahmanism and spirits. They love in peace and they are delicate, practice agriculture. The old people did not learn in school but new generations graduate compulsory level of education.

Some common rules in the livelihood of Karen involve greeting, eating, home visiting, and being joyful. The important practice in agriculture is rotational cultivation. They have certain plan of activities in the field for all year round, for example, making merit for the goddess of rice in January and harvesting in October and November.

The customs and traditions of Karen are various such as in giving birth, growing rice, death, pagoda merit making, and marriage. They respect in Chao-wat, making merit for spirits and the belief on the selection of land for agricultural practice.

Karen is the largest hill tribe in Thailand. In Uthai Thani Province, they live in the western part of the province with their unique in customs and culture. Their livelihood are strongly related to nature, simple life style with cultural-based agriculture such as sprinkling with curcuma water before worship because curcuma water compounds have various kinds of herbs from plants and recite an incantation over something. These results in 2 parts: qualifications in chemical and in holy substances. They have much worship that shows kindness and gratefulness in resource management such as animals involved in merit to animals that die when they slash and burn for cropping, using stream banks in various worship such as Loy Krathong Festival to pray for water for the reasons of believing that stream banks have moisture so when they have a problem about drought using the moisture in the area in worship can help them in communication, and they use big trees to prolong for more time every year that shows they depend on big trees in their beliefs and holy dimension because many kinds of animal live in big trees they use the behavior of the animals that means they are receiving everything from nature and the big tree is an agent of nature. (Uthai Thani Hill Tribe Assistance and Develop Center, 2001)

The majority of residences and agricultural areas of the Karen in Uthai Thani province are in the headwatershed. To understand their customs and culture clearly the researcher must live in the community for a long time.

8. Other relevant research

Application of participatory action research in the watershed's community resource management is rather small. However, some researches have taken into accounts participation of local people. Groups of research which were applied in this research were community forestry management research, participatory resource management research, indigenous knowledge in resource management research and community watershed

management research. For example, Chongtrakool (2000) studied about Community Forest Management in Tumbon Dan Khun Thot Organization, Changwat Nakhon Ratchasima and found that community forest management must consider the factors that affected participation. Phongsriwattana (2001) studied about Wat Tahmod Community Organization Council with Sustainable Natural Resource Management and found that the communities must have strong organization with vision and potential in management by themselves.

Some other researches include the study of Supapibun (1999) on Participation of Local People in the Management of Phu Kradueng National Park, Changwat Loei. Watthanaprachakul (1999) on Community Participation in Management of Klang Dong Forest Plantation, Amphoe Pak Chong, Nakhon Ratchasima. Ratchadowannapong (2000) on Farmer Participation in Economic Plantation Extensive Project at Amphoe Chondan, Changwat Phetchabun. Pinpak (2000) on People Participation in Forest Resources Conservation and Land Use at Ban Jan, Tambon Huai Sai, Amphoe Nong Khae, Changwat Saraburi. Aujchareyacheewin (2000) on People Participation in Forest Resource Conservation at Kog Nongtakrong Forest, Tambon Nong Ka Marn, Khu Mueang District, Buri Ram. Hlmsawat (2000) on Local People Participation in Forest Resource Conservation and Forest Reside in Kok Sa Ard Community Tambon Sakae Prong Amphoe Mueang, Changwat Buri Ram. Somwong (2000) on Community Participation in Forest Fire Control at Huai Kha Khaeng World Heritage Site and Pulpangnga (2000) on People Participation in Forest Conservation at Khao Phra Royal Project, Amphoe Nong Bua, Changwat Nakhon Sawan. However, the application of these studies have limited.

Regarding to indigenous knowledge in resource management research, Prechapanya and Sahunalu (1999) found that agroforestry system is one of the methods that help to reduce conflict but if indigenous knowledge in development is not considered its impacts on the watershed. Chutimathawin (2000) found that the pattern of Karen cultivation practice is one part of soil and water conservation. Choochat (1998) studied and found results that local people had manufacture system and livelihood based on conservation and sustainable cohabitation principles. Salim (2001) studied Karen Indigenous Knowledge about Watershed Management: A Case Study of Ban Mae Hae Tai Mou 9 Tumbon Panghinfon Amphoe Mae Chaem, Chang Chiangmai, and suggested to find out partial knowledge that may be lost and use it with the science process. Bourdang (1998) concluded about sufficiency economic that in hill communities and communities on the plains have practiced it for generations but it was damaged by some policies of government. She proposed to solve it in 5 parts.

In the case of community watershed management research, Seesomonn (2000) studied the Potential of Local Communities in Watershed Management: A Case Study of Huai Thap Salao Watershed, Changwat Uthai Thani and Changwat Nakhon Sawan, and found that local communities' potential was not related to watershed status because the study used some factors on science and social process. Onprom (2000) studied about forest management of communities in the hill zone of Khan watershed Chiangmai and found that community institutes had compound beliefs, rules and people networks, and had more efficiency than others established by external persons. He proposed for more strength in community institutes by acceptance in their resource management from government.

In conclusion, they used 4 kinds of research social processes about human and community and attempted to explain in the method of science process because in human

life everything is linked and cannot be divided into parts for implementation. The research that uses problem solving in social resource management must increase participatory action research for problem solving in watersheds and apply it to use in other areas.

The concepts integrated into this study i.e., a concept in watershed management and natural resources management, paradigms of community based watershed resources management, sustainable development, process of participation, participatory action research, concept and theory of conflict and Karen in Uthai Thani province, can help in status and problem analysis, problem solving participatory development process, testing alternatives, and establishing an action plan and guidelines for policy in watershed management. Relations of various theories in management are that the watershed has problems in management, forests were destroyed, wildlives were hunted, droughts, people are not happy with their livelihood, community and forest officer are in conflict, weak cooperation between community and officers. Social and cultural dimensions are not used in the resource management planning process, resulted in disappearance of community in the watershed management processes. The method used to reduce conflict must be clear in the concept and theory of conflict, starting with learning internal conflict of each person and using the teaching of religion as a guideline (The Four Noble Truths in Buddhism). Participatory action research is, therefore, a tool for solving a set of problems in places, and is applied to use in Huai Mae Di Noi watershed. For all of the process it was necessary for the researcher to live in the field with the community over a long time to collect data, with document results in each step for further analysis and report writing.

Research Area

1. Physical Characteristics of the Watershed

Huai Mae Di Noi watershed is in Ban Rai district, about 100 kilometers away from Uthai Thani province. The watershed has an area of 95,000 rai or 152 square kilometers. Most area is in the buffer zone of the Huai Kha Khaeng Wildlife Sanctuary which is the Natural World Heritage. The watershed is located between latitude $15^{\circ} 4' 37''$ - $15^{\circ} 13' 48''$ N and longitude $99^{\circ} 14' 13''$ - $99^{\circ} 22' 41''$ E. The highest and lowest elevations are 1,390 and 318 meters above mean sea level, respectively.

Huai Mae Di Noi watershed is a small and poor drainage watershed with total stream length of 136 kilometers, watershed perimeter of 62 kilometers with northwest aspect of slope. Compactness Coefficient (Kc) is 1.408. The number which is greater than 1 indicates that the watershed is not much different from circular shape with the main stream nearly in the middle of the area. Form Factor (FF) is 0.482 indicating that the watershed is rather in a square shape receiving moderate amount of rainfall. Relief Ratio (RR) is 0.060, mean slope is 34.34% or 15.45 degree and is categorized as the third watershed class. Mean Elevation (E) is 594 meter which is quite high and suitable for upstream area. Drainage Density (Dd) is 3.26 Kilometer/ square kilometers which is more than 1 indicating good drainage. Stream Density (Ds) is 4.65 stream numbers/square kilometers, indicating many stream numbers per area. Stream pattern is dendritic which is similar to vein pattern with uncertain direction. Stream profile is 25.26% which indicates poor drainage.

The watershed physical characteristic is the high area watershed with less slope and poor drainage because of a small number of streams per area. Northwest slope aspect affects on plant growth and transpiration. The details of physical characteristics of the watershed are shown in Table 1.

2. Watershed Biological Characteristics and Landuse

Huai Mae Dee Noi Watershed has high biodiversity. Most area, account for 90%, covers with natural forest. Main stream is Huai Mae Di Noi which is the perennial stream. Four types of forest have been found which are mixed deciduous forest, dry dipterocarp forest, evergreen forest and dry evergreen forest. Wildlife is plentiful because of the abundant forests.

2.1 Forest Type in the Watershed

Major rich evergreen forest of 1,500 rai was found in Huai Mae Dee Noi (Huai Ungwa) area, 3 kilometers far from BanYang Daeng Village with high humidity and cool all year round. This forest has not been disturbed by human. Along the roadway passing through the forest, there is some erosion during rainfall. The evergreen forest, approximately 2,000 rai, was also found within 2 kilometers along Huai Pong stream sides and approximately 1,000 rai along Khlong Salao stream sides. Therefore, the total evergreen forest area is 4,500 rai or 5.20% of the watershed area.

Mixed deciduous forest is the majority of all forest types found throughout the watershed covering an area of 65,000 rai or 75.14% of the watershed area with various plants such as *Azelia xylocarpa* (Kurz) Craib, *Xylia xylocarpa* (Roxb.) Taub. var. *Kerrii*

(Craib & Hutch) I.C. Nielsen, *Plerocarpus Indicu*, *Gmelina arborea* Roxb., *Dalbergia oliveri* Gamble ex Prain., etc.

Table 1 Huai Mae Di Noi Watershed physical characteristics

No.	Physical characteristics	Result	Unit
1	Watershed area	152.00	Square Kilometer
2	Total stream length	496.00	Kilometer
3	Watershed perimeter	62.00	Kilometer
4	Main stream length	22.00	Kilometer
5	The highest elevation	1,390.00	Meter
6	The lowest elevation	318.00	Meter
7	Watershed average length	17.75	Kilometer
8	Aspect	Northwest	-
9	First order stream	706.00	Stream
10	Compactness Coefficient (Kc)	1.408.00	-
11	Form factor (FF)	0.482	-
12	Relief ratio (RR)	0.060	-
13	Mean slope (S)	34.34	%
14	Mean elevation (E)	594.00	Meter
15	Drainage density (Dd)	3.26	Kilometer/Km ²
16	Stream density (Ds)	4.65	Stream/Km ²
17	Stream pattern	Dendritic	-
18	Stream profile	25.26	%

Dry dipterocarp forest is found next to the mixed deciduous forest covering an area of 13,000 rai or 15.03% of the watershed area. Main plant species are *Shorea obtusa* Wall. ex Blume, *Shorea siamensis* Miq., *Dipterocarpus Obtusifolius* Teijsm.ex Miq., *Dipterocarpus tuberculatns* Roxb., *Shorea roxburghii* G. Don., etc.

Dry evergreen forest is found in the East of the watershed with the altitude greater than 900 meters, covering an area of 4,000 rai or 4.62% of the watershed. At the highest peak of the Ma Oui Mountain (1,390 meters) is the abundant dry evergreen forest with various rare plant species such as Ma-Oui tree (Karen language) similar to kaffir lime but with bigger stem and fruit and *Cinnamomum bejolghota* (Buch.-Ham.) Sweet. This kind of forest is also found in Khao Yai Mountain which is the second highest mountain.

Wildlife found in the watershed are bear, *Bos guarus*, tiger, *Cervus unicolor*, *Muntiacus muntjak*, birds. Big wildlife which are elephant, bull cow, bull deer, tiger are normally found in the lowest area of the watershed, whereas small wildlife which are squirrel, bamboo rat, mole rat and bird are found all over the watershed.

2.2 Land use

There are 7 land use types in the watershed area: natural forest covering 90% of the watershed area, rotational cultivation area left only in Ban Yang Daeng, permanent agriculture in the area with slope less than 35%, agriculture in the high area with slope

greater than 35%, residential area with 5 communities, and other land use areas (see Table 2 and Figure 1-3)

Table 2 Landuse of Huai Mae Di Noi Watershed

No.	Land use characteristics	Area (rai)	Percentage area
1	Natural forest	84,200	88.631
2	Rotational cultivation	800	0.842
3	Agriculture	1,000	1.053
4	Steep slop agriculture	8,200	8.632
5	Community area	200	0.211
6	Water source	500	0.526
7	Other	100	0.105
	Total	95,000	100.00

There are 5 Karen's villages namely Ban Tai, Ban Khlong Salao, Ban Mai Khlong Ungwa 1, Ban Mai Khlong Ungwa 2 and Ban Yang Daeng or Ban Chaowad. Landuse in each village in Huai Mae Di Noi watershed is rather similar. Ban Khlong Salao has the largest area which is 26,000 rai and Ban Mai Khlong Ungwa 2 has the smallest area with 875 rai. However, the villagers access to other landuse zones.

3. Community

Karen communities have settled down in Huai Mae Di Noi for long time ago. The communities in Huai Mae Di Noi Watershed, consist of 5 villages as follows:

3.1 Ban Yang Daeng or Ban Chao Wad

Karen people's latest settlement in Ban Yang Daeng is 45 years. There are 25 houses with 98 people. Their typical tradition and culture are well conserved. All married men do not cut their hair but they keep it under the covered cloth. Other traditions are playing respect to the Chedi in every religious days, Yellow thread binding, New Year ceremony, age extending and ghost feasting ceremonies. The occupation of the villagers is cultivation. Land belongs to the community not to individual person. Crops mostly planted are rice, chili, egg plant, banana and corn. Ban Yang Daeng community and its land use are shown in Figure 4.

3.2 Ban Mai Khlong Ungwa 1

Ban Mai Khlong Ungwa 1 is the oldest community with the evidence of large tamarind and jackfruit tree. The latest settlement of the villagers in this area is 60 years with 41 houses or 197 persons at present. The culture is strictly reserved. The oldest villager is the leader of the ceremony. The villagers are separated into 3 groups which are yell thread, white thread and boiled water group. Main occupation is agriculture. Crops commonly planted are corn, rice, chili, eggplant and pumpkin. One part of the cultivating area is supported by the government and the other is an invaded area. Ban Mai Khlong Ungwa 1 community and its land use are shown in Figure 5.

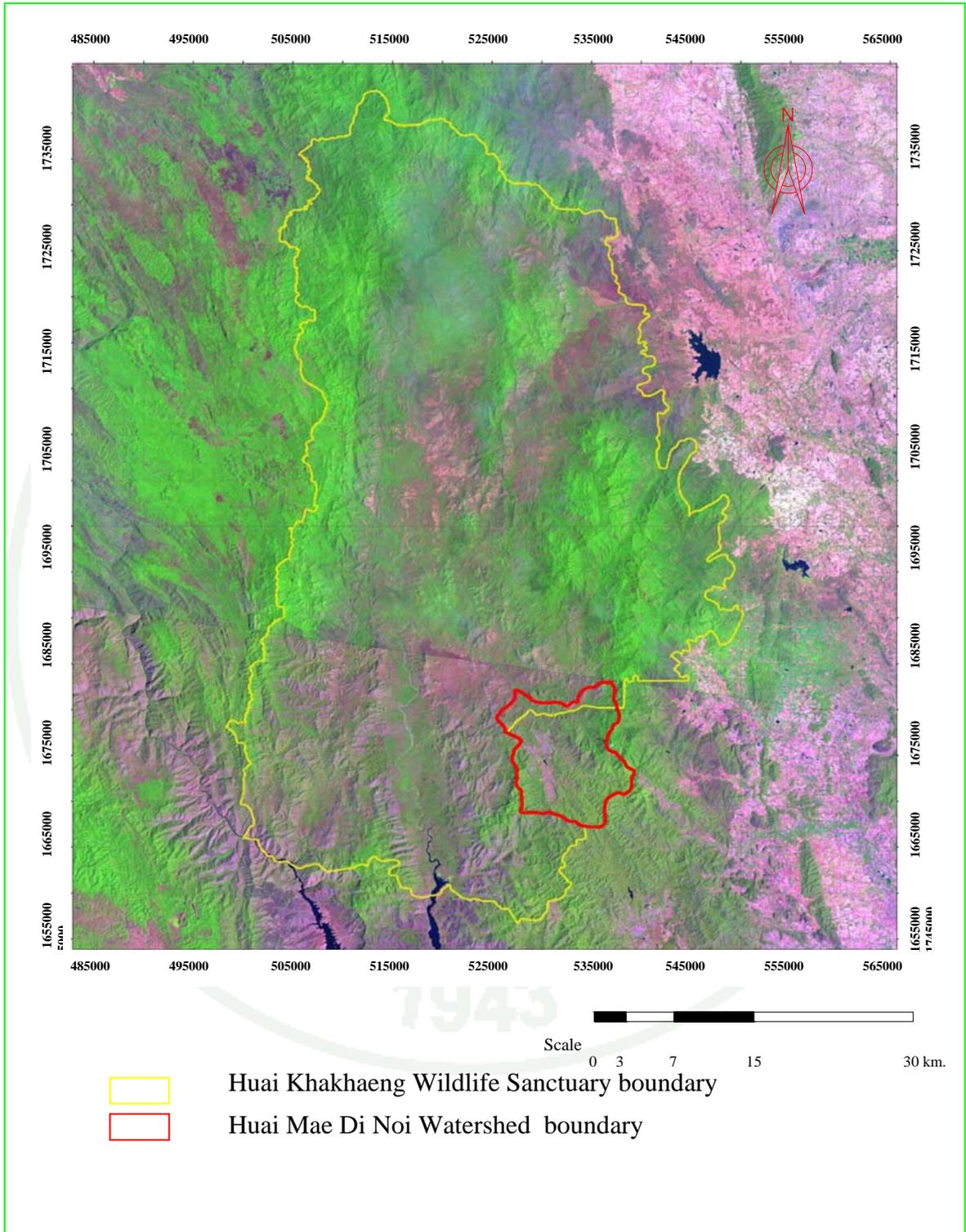


Figure 1 Huai Kha Khaeng Wildlife Sanctuary boundary and Huai Mae Di Noi Watershed boundary Uthai Thani province

Source: Modified from Nation Park, Wildlife and Plant Conservation Department (2005)

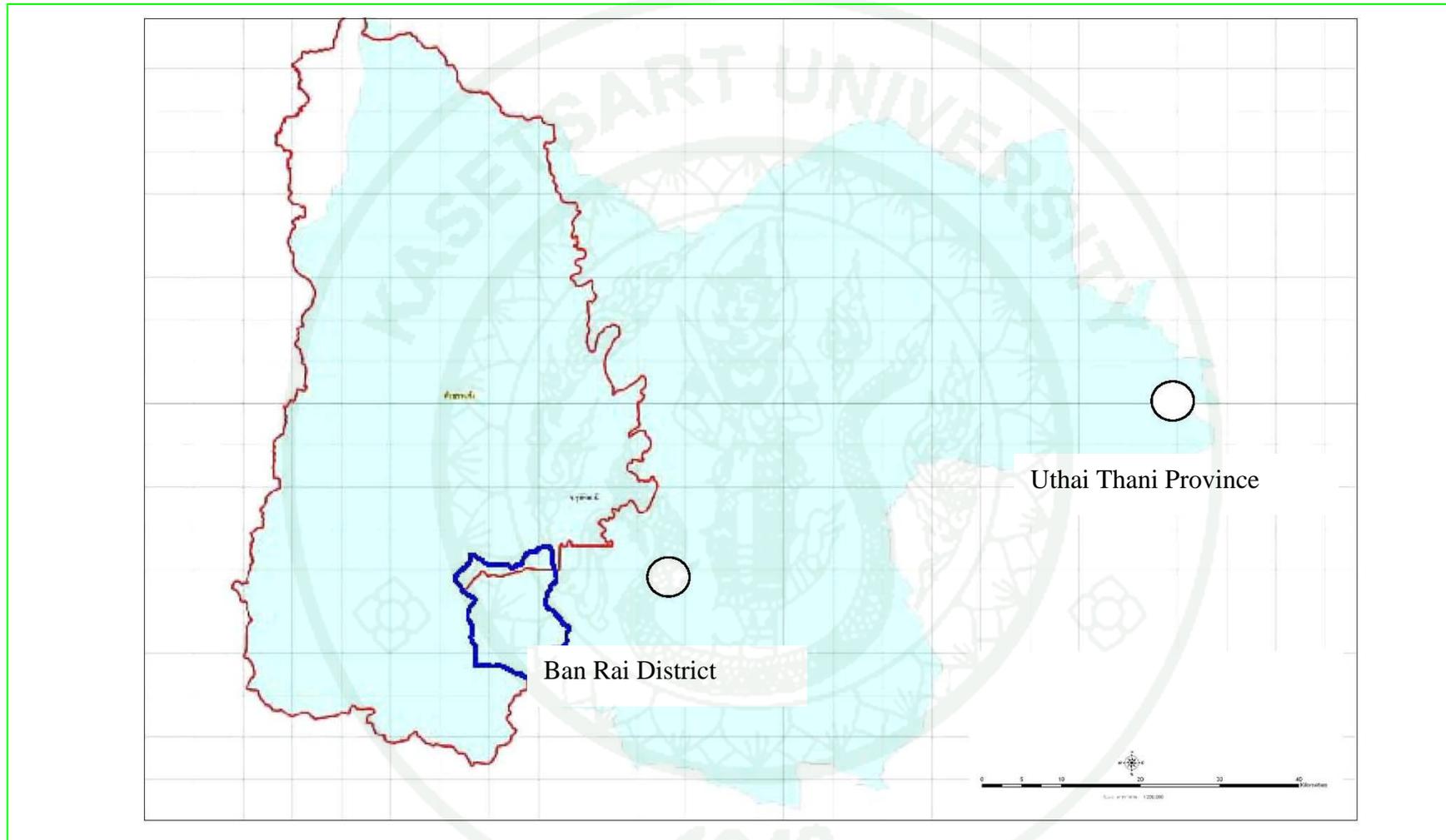


Figure 2 Uthai Thani Province, Huai Kha Khaeng Wildlife Sanctuary and Huai Mae Di Noi Watershed
Source: Modified from Nation Park, Wildlife and Plant Conservation Department (2006)

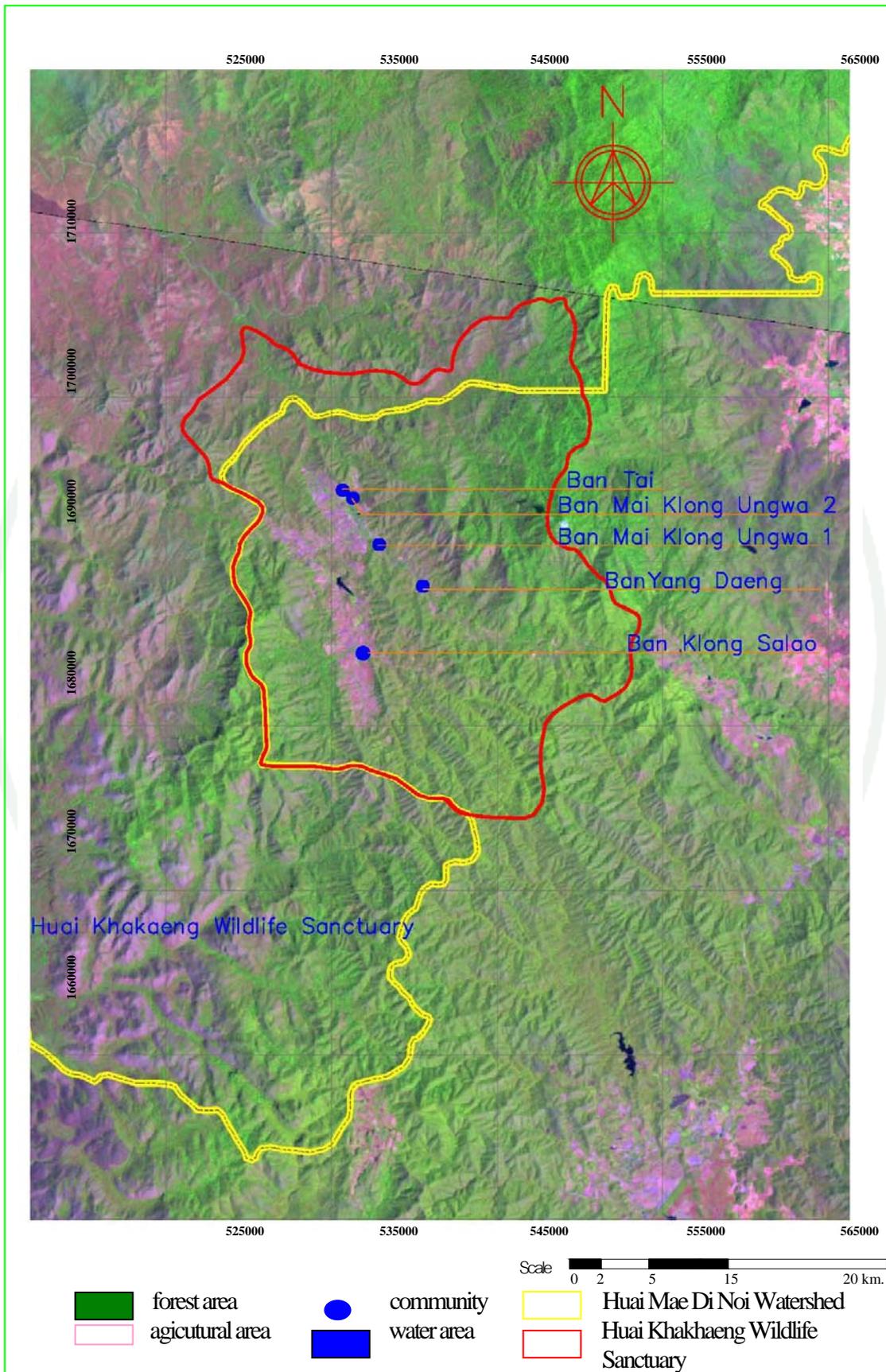


Figure 3 Landuse in Huai Mae Di Noi Watershed

Source: Modified from Nation Park, Wildlife and Plant Conservation Department (2005)



1-6 Livelihood in community

7-8 Agricultural and forest area

Figure 4 Community and Landuse Ban Yang Daeng



1- 4 Livelihood in community

5- 8 Agricultural and forest area

Figure 5 Community and Landuse Ban Mai Khlong Ungwa 1

3.3 Ban Mai Khlong Ungwa 2

The latest settlement of this community is 45 years along Huai Ungwa stream. It is 1 kilometer away from Ban Mai Khlong Ungwa 1 and connected to Ban Tai. There are 76 houses with 323 people. The community has more prosperity in terms of infrastructure than the others in the watershed because of its centered area with government offices such as hospital and school. The occupation is agriculture with corn, pumpkin, chili, egg plant, banana and water melon planting. The community and land use in Ban Mai Khlong Ungwa 2 are shown in Figure 6.

3.4 Ban Tai

This new community has been established in 1982. After the construction of Srinakarin dam and communist abolishment, the villagers were moved to settle in Ban Tai or Ban E Sai Mai. There are 39 households with 215 people. The occupation is agriculture with corn, rice, chili, egg plant, pumpkin, cucumber, water melon, cassava and rubber planting. The community and land use in Ban Tai are shown in Figure 7.

3.5 Ban Khlong Salao

The latest settlement of this community is 50 years with the first leader Mr. Pongyo Moddaeng. From 5 houses in the first period, the area of 25 rai was allocated to each 65 houses after the dam construction and communist movement. The occupation is agriculture with rice, corn, chili, water melon and pumpkin planting. The community and land use in Ban Khlong Salao are shown in Figure 8.

The social characteristics of communities in Huai Mae Di Noi Watershed are shown in Table 3.



1-6 Livelihood in community

7-8 Agricultural and forest area

Figure 6 Community and Landuse Ban Mai Khlong Ungwa 2



1-3 Livelihood in community

4-8 Stream, agricultural and forest area

Figure 7 Community and Landuse Ban Tai



1-6 Livelihood in community

7-8 Agricultural and forest area

Figure 8 Community and Landuse Ban Khlong Salao

Table 3 Socioeconomic characteristics of communities in Huai Mae Di Noi Watershed Ban Rai District, Uthai Thani Province

No.	Village	Population/household (person/unit)	Occupation		income/year (baht)	Education		
			Agriculture	Others		None	Primary school	Secondary school
1	Yang Daeng	98/25	100	-	25,000	23	2	-
2	Mai Khlong Unqwa 1	1197/41	100	-	30,000	30	5	6
3	Mai Khlong Unqwa 2	323/76	89	-	40,000	51	12	13
4	Tai	215/39	87	-	50,000	25	6	8
5	Khlong Salao	380/65	100	-	39,000	50	12	3

Conceptual Framework of the Study

Watershed system compounds to diversity of physical and biological resources. Human resource is part of the watershed system that can have both positive and negative impacts to the watershed area. The method that use for the balance of watershed system must be taken into consideration the integrated management of all resources. As communities are part of the watershed, community participatory is, therefore, the essential factor in resource management process. Watershed management in the past was not successful due to overwhelming external intervention. The research on community-based resource management was little. Participatory watershed management included the study of physical and biological features as well as interpreted community knowledge and their behavior in such a way that are acceptable by scientific principle.

Right attitude and understanding of community of the researcher is one of the primary factors in participatory watershed management. Karen communities in the research area are in a transition period of change in their tradition and culture influenced from outsider. Some communities are old while the other recently immigrated and some were relocated by the government. To search for facts and in-depth data, research methodology must overcome most of problems over various factors.

This study consisted of 2 parts, an area and resources and community. In conceptualizing this research, the participatory action research process was introduced to know situation and problems both positive and negative one.

The first part covered physical feature, geography and land use using topographic map, land use map and watershed classification map together with field survey with villagers in the community and relevant government officers. GPS and maps were used to mark important locations and overlaying map to check and validate the data. The in sight view of community was incorporated in the data analysis processes.

Status and problems in the watershed were divided into 7 groups and 5 communities based on existing village number. Data was analyzed and concluded in descriptive form.

The research process related to the people or community began with rapport building by way of long staying with villagers in the communities. Participating various kinds of social activities in the villages. Then, situational analysis was started. Methods in collecting social information are dialogues, collecting secondary data, in-depth interview and participatory observation. Data was documented and the results on status and problem were used to prepare plan for action, and following with the implementation of the plan. Data was analyzed and knowledge, experiences and lesson learned were concluded and used in the next learning cycle.

Situation and problems are divided into 3 parts, i.e., social, economic and environment.

The next step is the participatory problem solving process based on nature of community behavior. All methods are implemented continuously in an integration manner. Researcher has taken role in coordinating all concerned persons to take part in each step of action.

A number of methods using in problem solving and development processes were individual and group discussion, public hearing, training/workshop and fieldtrip.

The result of participatory problem solving and development process was concluded, tested and applied into the watershed management activities. Concept of this study was shown on figure 9.



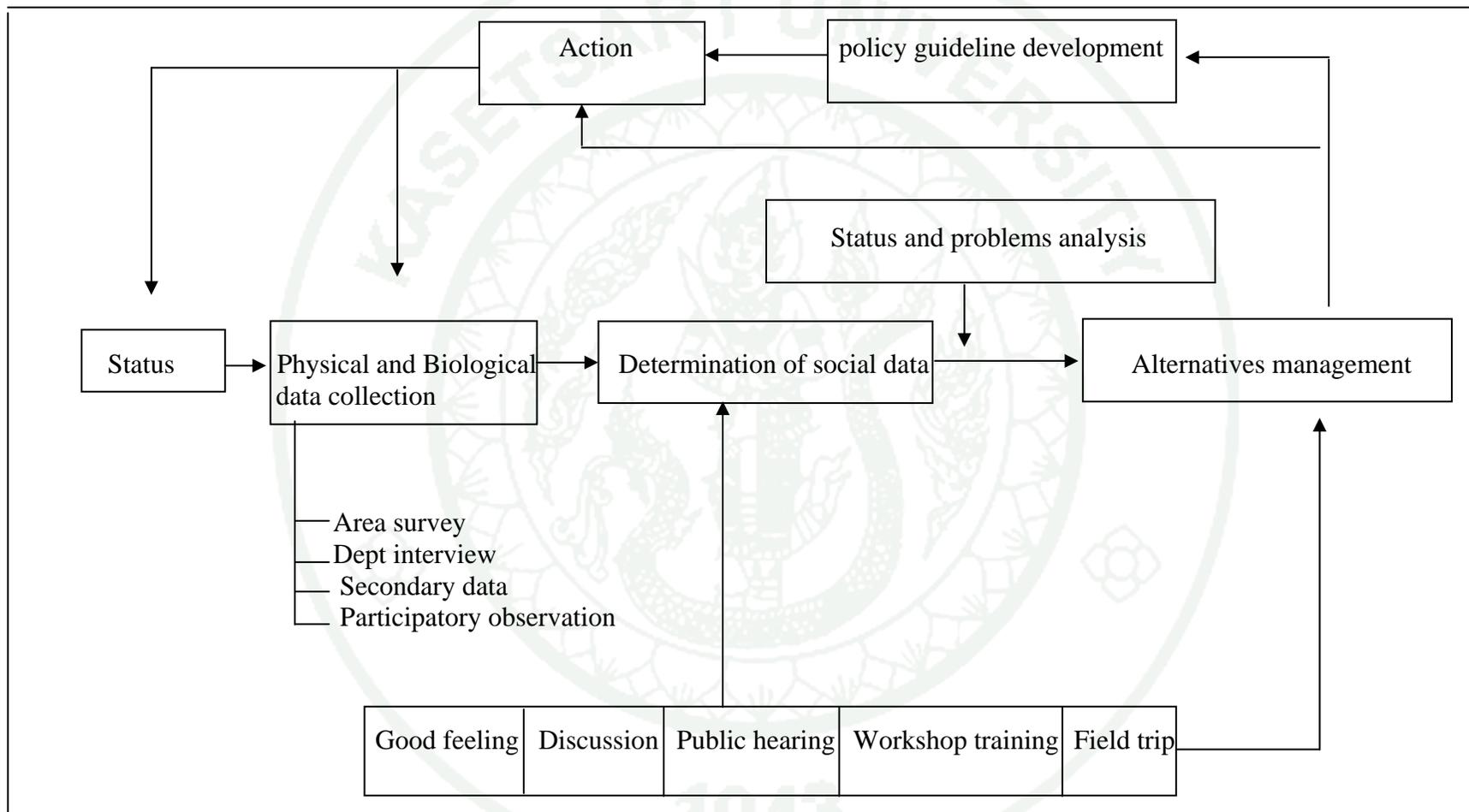


Figure 9 Concept of study in participatory problem solving and development process

MATERIALS AND METHODS

Materials

Materials in this study are topographic map, aerial photo, Satellite, GPS., computer, tape, camera and video recorder etc.

Methods

This research methodology consisted of data collection, data analysis and conclusion. The 246 households or 1,213 people in 5 communities participated in this study. Some statistical inferences employed in this study were percentile, mode and medium.

1. Data collection

Data collection included general characteristics of the watershed, situation and problem.

1.1 General characteristic of watershed. This data set consisted of geophysiographic and biological characteristic data and social characteristics data.

In collecting geophysiographic and biological characteristic data, some steps were conducted as follows:

1.1.1 Topographic map scale 1 : 50,000, watershed classification map, aerial map and satellite map were used to mark watershed boundary, community locations, land use types, watershed classification and other.

1.1.2 Forest types were identified based on secondary data and field survey.

1.1.3 Wildlife species and quantity were conducted by interviewing villager in each village.

Social characteristics and history of the community data were collected during January 2004, by interviewing heads of every household.

1.2 Situation and problems: Data on situation and problem of the watershed and communities were collected by indept interview, reviewing secondary data, participatory observation.

Indept interviews were conducted with 10 villager group or 230 villagers and local government officers in each agency during 2 January to 30 April 2004 to collect data on situation and problems. Elderly people were interviewed for cultural data. The key persons in the interview were shown in appendix 1.

In data collection process, tape recorder and camera were used to document general data of the villagers, their knowledge as well as real watershed management activities event in terms of positive and negative impacts. Data sets were arranged into social, economic and environmental groups. The environmental part was further divided into 4 parts, i.e., soil, water, forest and wildlife.

Secondary data of watershed management was collected from October to December 2003, including 1) cultural changes that cause problems in the community, 2) career problems that cause changes in the community, and 3) natural resource and environmental management in the past. All gathered data were used to analyze the changes of community livelihood and natural resources.

In participatory observation, 27 research team members stayed with villagers from January 2001 to March 2004 to collect data by observing activities in the communities including soil, water, forest and wildlife management. Data was compiled and interpreted into situation and problems in the watershed.

1.3 Participatory problem solving and development processes: Situation and problems data were used to establish the participatory problem solving and development process in line with the balance of the social, the economic and the environmental system.

Indicators for the balance of the watershed system included social indicator, economic indicator, and environment indicator. Social indicator consisted of culture reserved and happiness of community. Economic indicator consisted of efficiency economy of living. Environmental indicator consisted of soil (land utilization based on agreement of community, government and researcher), water (water utilization based on principle of water conservation), forest: (no encroachment of forest land), and wildlife (no hunting of every kind of wildlife).

The problem solving and participatory development process was used through 4 steps as follows:

1.3.1 Discussion: Discussion was organized by individual villager and in group with 246 people. The informal discussion was organized based on their readiness and availability of the villager. Data was documented and concluded during the discussion process.

Prioritized situation and problems of the communities and the watershed were brought into the discussions in the community with selected target persons during March and May 2004. The issues on situation and problems were discussed in a village basis while the watershed management issues were discussed in group with members from each community.

1.3.2 Public hearing

Public hearings were organized in three different levels, i.e., within subgroup, with the village group, and with the whole watershed. With this, the public hearing with 13 subgroups, 5 villages, and the whole watershed were organized. Documentation and analysis of data in each hearing were organized for further building of management alternatives.

1) Public hearing in subgroup: Public hearing in small group was organized from March to May 2004 with the aim to collect data in every small community groups. Based on household locations, community was divided into 13 groups; 2 groups in Ban Yang Daeng, 2 groups in Ban Mai Khlong Ungwa 1, 3 groups in Ban Mai Khlong Ungwa 2, 2 groups in Ban Tai and 4 groups in Ban Khlong Salao. Alternatives of problem solving and watershed management were developed.

2) Public hearing for the whole village: Public hearing was organized for each village group in May 2004. Each meeting took about 3 hours. Activities along public hearing process were documented.

3) Public hearing for the whole watershed:

Public hearing for all community groups in the watershed was organized for one day at Tambol Organization Administration of Kan Ma Krud with the aim to establish participatory problem solving and development processes in the watershed. The participants in this meeting were representatives of each public hearing group. Documentation was made to collect and analyse data during public hearing processes for further action.

1.3.3 Workshop training: Training/workshops were organized in the communities to share knowledge and information between villagers and government technical officers. This activity was based on the assumption that villagers who participated in the training/workshop could initiate and develop idea and framework for solving problems in differences of social, economic and environmental aspects. The training/workshops were implemented in May 2004 after the completion of discussion and public hearings.

The training course on natural resource and environmental management was organized in May 2004. A case study of Huai Mae Di Noi Watershad was used in training course. Representatives of communities, 130 persons or 50% of total household in watershed, participated in the training course.

1.3.4 Field trip: Field trips were organized to widening villagers' views and better understanding of watershed situation and problems similar to them so that they will be able to apply new knowledge and experiences to work in their communities.

The field trip was organized after training with an objective to learn on occupation development, custom, culture, and natural resource and environmental conservation at Lai Vo subdistrict, Sangkla Buri district, Kanchana Buri province in March 2005. A number of 65 representatives of community and officer were participated.

Results from the participatory problem solving process in 1.3.1 – 1.3.4 can be summarized in descriptive form with figure.

1.4 Alternative and testing in participatory watershed management.

Alternatives of watershed management are the output of situation and problem solving analysis. There are watershed management alternatives in 5 communities. These alternatives have been tested in collaboration with communities and local government agencies. Indicators for measuring the success of the implementation were set up and used. Alternative to participatory watershed management is shown in figure 10.

2. Data analysis

Data of situation and problems was analysed as follows:

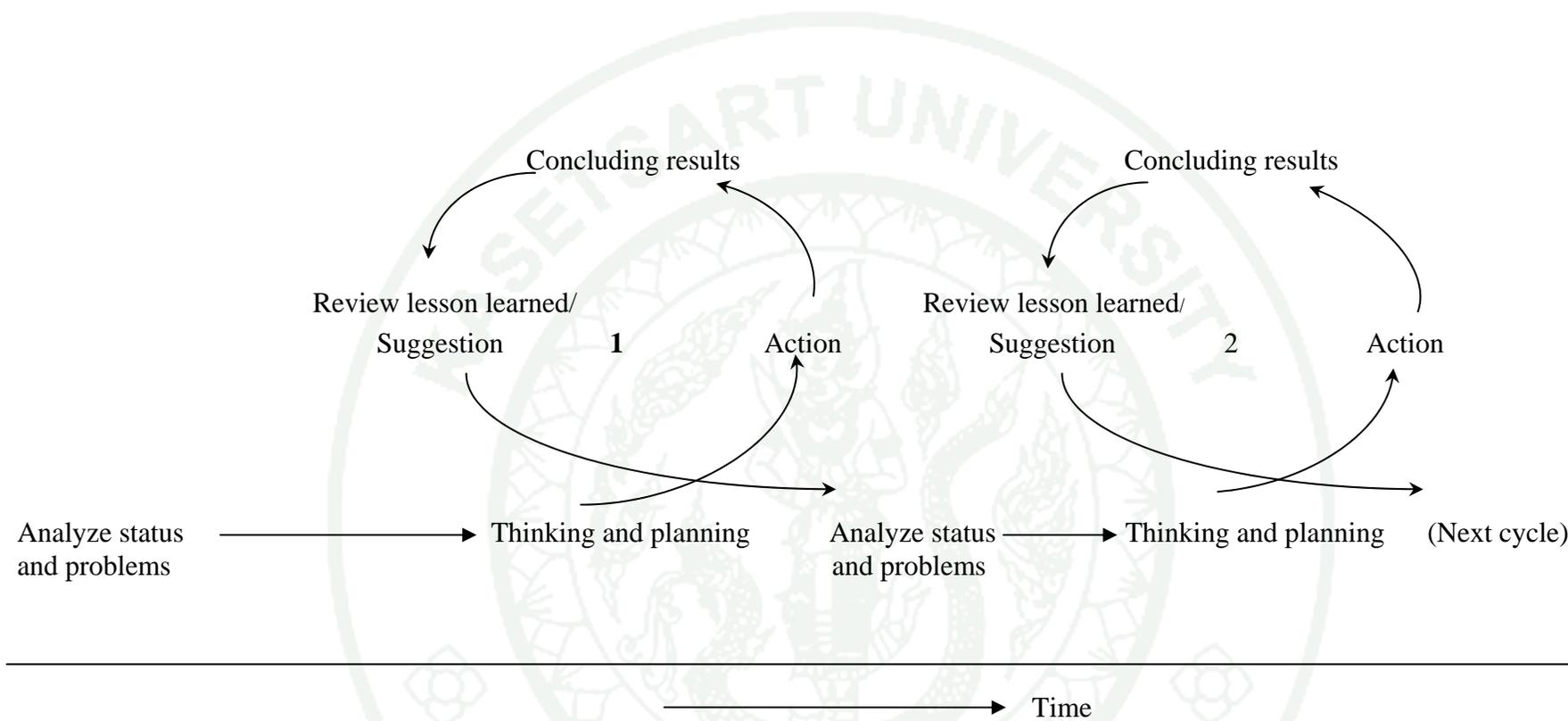


Figure 10 Cycle of participatory action research in watershed management

Source: Makarabhirom (2002)

2.1 Situation and problems: Situation and problems, both positive and negative, were prioritized and classified in social, economic and environmental groups in each community. Further analysis were data comparison and data valuing.

2.1.1 Status and problem comparing: Data comparison was determined based on ranking of high, medium and low.

- High is the real event frequently occurred, more than 60% of the total events, in the community and affected to the community at large.

- Medium is the real event in moderately occurred, from 50-60 % of the total events, in the community

- Low is the real event rarely occurred, lower 50% of the total events, with small impacts to the community.

2.1.2 Status and problem importance level: The important level of the status and problem was determined by scoring, one score for one interviewed person.

2.2 Establishment of participatory problem solving development processes.

Establishment of participatory problem solving development process in this process include the discussion, the public hearing, the training/workshop, and the field trip and integrated the results of the process into the alternatives of watershed management and choose the best one for further implementation by community members.

2.3 Alternative and testing of participatory watershed management

All 75 participatory watershed management alternatives were experimented through cycles of participatory action research processes which consisted of situation analysis, planning, implementing and concluding lesson learnt for the next round process. In each implementation step, the performance will be translated into numeric system and on percentile and compare with indicators. The agreed alternatives have to be met with the given indicators.

2.3.1 Determination of percentile: In keeping balance of the watershed system, weighed score was given 33% equally to the social, economic and environmental indicators and 25% was given to each soil, water, forest, and wildlife components of the environment characteristics.

2.3.2 Determination of area percentile: For the integrity of the administration and management of natural resource, each community out of 5 communities was given 20%.

3. Conclusion of the analysis

The result in each alternative was integrated into the community and the watershed level.

RESULTS AND DISCUSSION

This chapter was divided into 3 parts; 1) the watershed situation and problem were described, 2) the participatory problem solving process was elaborated and 3) watershed management alternatives were analysed.

1. Situation and problem

Watershed's situation and problems have been categorized into positive and negative situations. Positive situation is the outstanding event occurred in the community and/or in the watershed and affected to the development process and the negative situation which caused problems and was brought into the participatory planning process to solve the problems both community and watershed levels in the following steps.

1.1 Positive situation

Positive situations which contribute to the easy lifestyle, abundant of natural resource and happiness for generations are divided into 3 groups: social, economics and environmental sector, as follows,

1.1.1 Social situation

Positive social situation consisted of 14 events as follows:

- 1) Habitation reliability: villagers trust to their neighbor i.e., no fencing, connection of frontyard, no problem with burglary
- 2) Children unity: children can go and play in another houses without group separation.
- 3) Participating in merit making and village development: villagers do merit making and village development activities voluntarily in monastery area, roadsides, village public area in every religious day. Based on the study from January to December 2004, approximately 80% of total villagers participated in the merit making and village development (see appendix)
- 4) Use of their own tribal language: keeping local tribal language survive significantly effected local knowledge and wisdom, therefore using local tribal language help keeping local knowledge and wisdom of the land.
- 5) Strict to tradition and culture: villagers follow tradition and culture in simple living, respect to nature.
- 6) Keep practicing worship of nature: i.e., extending lives of big trees and stream which stream and big trees were well protected.
- 7) Uniqueness of the tribe i.e. dressing with local costume that made from local material such as cotton. At present, only 5 households planted cotton and use it for weaving.

8) Don't believe outsider easily: Once the outsider comes to the village, the children will go away except getting permission from elderly people.

9) Respecting to leader: Once anyone in the village was chosen into the leader, the villagers will believe him, follow him and pay respect to him. This resulted in the easiness in building

10) Transforming of local wisdom: local wisdom in living and farming transferred into the next generation. Yang Daeng community has practiced rotational cultivation to feed their economy that are closely related to the nature for generations. Local wisdom includes land selection, land preparation, cultivation etc.

11) Solving problems by democracy way: In case of conflict within and between communities, particularly during January to December, 2003, communities have encouraged elderly people in the community together with other stakeholders to participate in the conflict management process: in the democratic manner.

12) Simple living with nature: this situation described simple living condition, construction of house with local material in simple way, make their living based on their natural resources and live together happily in a community.

13) Self confidence and reliance: One important behavior of the villager is the way of behaving. The villager has normally spent time in their daily life such as fishing, farming, with confidence.

14) Close relationship among cousins: Their relationship within clan is quite strong. This resulted in both positive and negative sides in development such as giving hand to protect forest as well as to destroy forest.

In sum, positive situation in Huai Mae Di Noi are among the strict reservation of culture, transferring of knowledge on nature that resulted in sustaining their livelihood for generations. Ban Yang Daeng had the highest value indicating better society than others, whereas Ban Khlong Ungwa 2, Ban Tai and Ban Khlong Salao had the low value indication the alteration (see details in Table 4).

1.1.2 Economic situation

Positive situation in term of economy consisted of 10 situations.

1) Gain support from related government offices: Many government agencies have interested in communities' development activities. They have helped providing some agricultural material such as plant seeds, animal. .

2) Plant and sell local vegetable. A number of local vegetable such as pumpkin, guard, egg plant, cucumber etc, has been planted in the backyard and along the canal for their own consumption and for sale.

3) Aquaculture in shrimp, crab, fish for consumption: A reservoir with water for all year round of approximately 200 rai has been managed by the villager and the government official for freeing small fish and make use of them.

Table 4 Positive social situation

No.	Situation	Quantity of situation in communities					Note.
		Ban Yang Daeng	Ban Mai Khlong Ungwa1	Ban Mai Khlong Ungwa2	Ban Tai	Ban Khlong Salao	
1	Habitation reliability	3	2	2	2	2	1 = low
2	Children without group separation	3	2	2	2	3	2 = medium
3	Develop every religious day	3	3	2	1	3	3 = high
4	Use of their own language	3	3	3	3	3	
5	Tradition reservation	3	2	2	2	2	
6	Nature worship	3	2	1	2	2	
7	Uniqueness of the tribe	3	2	2	2	2	
8	Don't believe outsiders tribes	3	3	2	2	2	
9	Respect to the leader	3	2	1	3	1	
10	Transfer local wisdom	3	2	2	2	2	
11	Solve problems by democratic way	3	2	2	1	2	
12	Natural based living	3	2	1	2	1	
13	Self confidence	3	2	2	1	1	
14	Close relationship among cousins	3	2	2	2	2	
Average		3	2.21	1.86	1.93	2	
Average (watershed)				2.20			

4) Natural living particularly on food: Majority of the people has gained knowledge and experiences in making a living in connection with the forest. They know various kinds of natural food including mushroom and vegetable that can be collected from the forest.

5) Good performance in some occupation i.e. Shitake mushroom culture: Most area in Mae Di Noi watershed has been in a high altitude with cold climate, this supported mushroom culture for additional income.

6) Good condition of resources for agriculture i.e. soil, water: Major occupation of villager has been in agriculture. Therefore, good natural resource condition can be positive circumstance in terms of watershed management.

7) Area with high potential for agricultural production: There are varieties of cultivated land characters such as highland sloping area, moderated slope area, valley area, flat area along riversides, and rotational cultivation area. This condition creates higher opportunity and potential for increasing agriculture production.

8) Famous Karen chili: With site specific characteristics of climate and soil, there has been a karen-variety chili that gives a very special good smell and hot taste and can be kept for long. The villagers earn income by planting this variety of chili.

9) Various activities in agricultural area: different characters of agricultural area that enhance variety of activities in agricultural area.

10) Agricultural products supported by merchants: Agricultural products can be sold in the market.

Positive economics situation shown on table 5

1.1.3 Environment

Positive environmental situation consisted of 5 situations.

1) Abundance of natural resource condition: Approximately 90% of the watershed area has been rich of forest, yielding water to the stream with good quality and quantity.

2) Good weather providing good environment for visitors: .

3) High potential area for ecotourism.

4) Supports from conservation network

5) High area far away from disturbance of the city

Ban Yang Daeng, BanTai and Ban Khlong Salao had the high value, whereas Ban Mai Khlong Ungwa 2 had the low value but still in the high range indicating good environment.

Positive environmental situation shown on table 6

Table 5 Positive economics situation

No.	Condition	Quantity of circumstances in communities					Note.
		Ban Yang Daeng	Ban Mai Khlong Ungwa1	Ban Mai Khlong Ungwa2	Ban Tai	Ban Khlong Salao	
1	Gain support by related offices	2	3	3	3	3	1 = low
2	Plant and sell local vegetable	3	3	2	2	2	2 = medium
3	Aquaculture for consumption	2	3	2	2	2	3 = high
4	Food dependency	3	2	2	2	2	
5	Occupation	3	3	2	2	2	
6	Condition of agriculture	3	3	3	3	3	
7	High potential area for agricultural products	3	3	3	3	3	
8	Famous Karen chili	3	3	3	3	3	
9	Various activities in agricultural area	2	2	3	3	3	
10	Agricultural products were supported by merchants	3	3	3	3	3	
	Average	2.70	2.80	2.60	2.60	2.60	
	Average (watershed)		2.88				

Table 6 Positive environmental situation

No.	Situation	Quantity of Circumstances in communities					Note.
		Ban Yang Daeng	Ban Mai Khlong Ungwa1	Ban Mai Khlong Ungwa2	Ban Tai	Ban Khlong Salao	
1	Abundant natural resources	3	3	3	3	3	1 = low
2	Good weather affecting on many visits	3	2	2	3	3	2 = medium
3	High potential area in ecotourism	3	3	3	3	3	3 = high
4	Support from conservation network	3	3	2	3	3	
5	High area far away from the city	3	3	3	3	3	
	Average	3.0	2.80	2.60	3.0	3.0	
	Average (watershed)			2.88			

1.2 Negative situation

Negative circumstances were divided into 3 categories; social, economics and environment.

1.2.1 Social situation

Social situation can be divided into 3 groups according to their problems:

1) Community without or less social problems: example was Ban Yang Daeng because of its strict culture and tradition respect.

2) Communities with moderate social problems. There were Ban Mai Khlong Ungwa 1 and Ban Khlong Salao as 75% of the villagers still respect to the tradition.

3) Communities with high social problems. There were Ban Tai and Ban Mai Khlong Ungwa 2. These two villages shared village boundaries. There were more economic development than the others with various shops especially liquor shops.

Social problem in general can be summarized as follows;

- 1) The villagers had less responsibility for their local communities.
- 2) The leader has high potential in development.
- 3) Activities of the official leader and natural leader did not get along well.
- 4) Uneducated villagers.
- 5) Villagers spent less time on work.
- 6) The elderly people were not happy with the occupation.
- 7) Miss language communication with outsiders.
- 8) Local influence from new migrants in the area.
- 9) Outsider-based development.

Negative social situation in term of society was shown in table 7

1.2.2 Economics

Negative economic situation of the communities were grouped as follows:

1) Community with less economic problem: Ban Tai, Ban Mai Khlong Ungwa 1, Ban Mai Khlong Ungwa 2 and Ban Khlong Salao had many economics problems.

Table 7 Negative social situation

No.	Situation	Quantity of Circumstances in communities					Note.
		Ban Yang Daeng	Ban Mai Khlong Ungwa1	Ban Mai Khlong Ungwa2	Ban Tai	Ban Khlong Salao	
1	The villagers had less responsibility for the local	1	2	3	3	2	1 = low
2	The leader has potentiality	2	3	2	3	3	2 = medium
3	Activities of leader didn't get along well	1	2	3	2	2	3 = high
4	Uneducated villagers	3	3	3	3	3	
5	Villagers spent less time on work	1	2	2	2	2	
6	The older were not happy with the occupation	1	2	3	3	2	
7	Communication and language understanding	3	2	2	3	2	
8	Benefit among the area	1	2	3	3	3	
9	Outdoor culture development	2	2	3	3	3	
Average		1.67	2.22	2.67	2.78	2.44	
Average (watershed)				2.36			

2) Community with much economic problem: Ban Yang Daeng had less economics problems because of the natural living.

Economic situation can be concluded as follows:

- 1) Villagers were in debt.
- 2) Villager had uncertain occupation.
- 3) Shortage of water for agriculture.
- 4) Influence on land owning and agricultural products selling.
- 5) Inconvenient transportation.
- 6) No management of recreation area.
- 7) Unfair agricultural products given by the merchants.
- 8) Occupation support was not met the villager's needs.
- 9) Too rapid development i.e. electricity.

Negative circumstances in term of economic were shown in table 8

1.2.3 Environment

Negative environmental situation can be grouped as follows:

1) Community with much environmental problems: Ban Khlong Salao, Ban Mai Khlong Ungwa 2 and Ban Tai had many environmental problems in resource uses, land owning, agricultural area extension, chemical substance usage and forest fire.

2) Community with moderate environmental problems: There was Ban Mai Klong Ungwa1.

3) Community with less environmental problems: i.e. Ban Yang Daeng.

Environmental situation can be concluded as follows:

- 1) Some villager groups did not understand appropriate resource uses.
- 2) Conflict on land use.
- 3) Villagers get used to extensive agricultural system.
- 4) No agreement in resource uses.
- 5) Application of chemical substance in the upstream area.

Table 8 Negative economics situations

No.	Situation	Quantity of Circumstances in communities					Note.
		Ban Yang Daeng	Ban Mai Khlong Ungwa1	Ban Mai Khlong Ungwa2	Ban Tai	Ban Khlong Salao	
1	Villages were in debt	1	3	3	3	3	1 = low
2	Uncertain occupation	2	3	3	3	3	2 = medium
3	Water shortage for agriculture	1	1	1	1	1	3 = high
4	Influence on land owning	-	2	3	3	3	
5	Inconvenient transportation	3	3	3	3	3	
6	Non potential management area	1	2	2	2	2	
7	Villagers were taken advantage by merchants	1	3	3	3	3	
8	Unsustainable occupation support	3	3	2	3	3	
9	Rapid development	1	3	3	3	2	
Average		1.44	2.56	2.56	2.67	2.56	
Average (watershed)				2.36			

- 6) Imitate way of living from the low land villagers.
- 7) Inconvenient transportation.
- 8) Forest fire.
- 9) Wildlife hunting for trade.

Negative circumstances in term of environment were shown in table 9

Based on participatory problem solving and development procedure in five communities and the whole watershed, 75 alternatives to watershed management have been developed. The most important status and problem in each component (social, economic and environment) of the community and watershed was selected in Ban Yang Daeng for further implementation Ban Yang Daeng has 12 alternatives, i.e., 1) positive situation in culture strict development, 2) negative situation in inappropriate teenage behavior, 3) positive situation in easy lifestyle and happiness living, 4) negative situation in heavy monocropping for trade, 5) positive situation in rotation cultivation, 6) negative situation in disagreement in rotation cultivation land use solving, 7) positive situation in rich water resource in stream, 8) negative situation in water resource mismanagement, 9) positive situation in diversity of forest and bioresources, 10) negative situation in disagreement in forest resource management, 11) positive situation in abundant of wildlife and 12) negative situation in wildlife hunting. In the case of Ban Mai Khlong Ungwa 1, Ban Mai Khlong Ungwa 2, Ban Tai, Ban Khlong Salao and Watershed overview most important status and problem has similar result to Ban Yang Daeng that were shown in table 10-11.

The main problem in Mae Di Noi watershed was resource usage without conservation for instance land invasion for agricultural area. There was no management corresponding to the problems, so participation process was developed by analyzing the situation both in positive and negative ways within 5 villages and the watershed.

The situation and problems analysis in Huai Mae Di Noi watershed revealed that the irregular working of the responsible government office and lacking co-ordination affected on the uncertainty in the area and land usage of the villagers. Therefore they invaded the forest area, hunted the wildlife and imitated the way of lives from the low land area. Moreover, there were conflicts between villagers, inappropriate behaviors such as alcohol drinking and quarrelling. The relation of problem was shown in figure 11

Table 9 Negative environmental situation

No.	Situation	Quantity of Circumstances in communities					Note.
		Ban Yang Daeng	Ban Mai Khlong Ungwa1	Ban Mai Khlong Ungwa2	Ban Tai	Ban Khlong Salao	
1	Not understanding in resource usage	1	2	3	2	3	1 = low
2	Conflict in land area	-	2	3	3	3	2 = medium
3	Extensive agriculture	-	3	3	3	3	3 = high
4	No agreement in resource usage	-	2	2	2	3	
5	Chemical substance usage in the upstream	1	2	3	3	3	
6	Imitate way of living from the low land villagers	1	2	3	3	3	
7	Inconvenient transportation	3	3	3	3	3	
8	Forest fire	1	3	3	3	3	
9	Wildlife hunting	1	3	3	3	3	
Average		0.89	2.44	2.89	2.78	3.0	
Average (Watershed)				2.40			

Table 10 General status and problems in communities and in watershed

No.	Village	General Status	Note.
1.	Ban Yang Daeng	Strict in culture, rotation cultivation, complete in natural resource caring	Social dominant
2.	Ban Mai Khlong Ungwa 1	Strict in culture, diverse career, land use in steep slope with high erosion.	Economic dominant
3.	Ban Mai Khlong Ungwa 2	Diverse career and wide plain area for agriculture.	Environment (soil) dominant
4.	Ban Tai	Power of influence persons in effective land use and	Environment (water) dominant
5.	Ban Khlong Salao	High harmonious, wide agriculture area, land using by other community.	Environment (forest) dominant
6.	(Watershed)	Clearly in tribe culture, good in natural resource caring	Environment (wildlife) dominant

Table 11 Dominant and importance problem

Village	Social	Economic	Environment			
			Soil	Water	Forest	Wildlife
- Yang Daeng	+ Culture strict	+ Easy and happiness living	+ Cultivation rotation	+ Complete forest area and stream	+ Forest and Biodiversity	+ Various wildlife
	- Teenage behavior	- Short term single cropping	- Disagreement in cultivation rotation	- Mismanagement in water resource	- Disagreement in forest resource manage process	- Small wildlife hunted
- Mai Khlong Ungwa 1	+ Culture strict 75%	+ Stable career	+ Over fertilizer use	+ Huai Mae Di Noi that complete stream	+ complete forest and pretty view	+ Various wildlife
	- Bad behavior copy	- Browbeat crop trade	- Steep slope land use	- Chemical residues in stream	- Encroach forest and change into cultivate land	- Wildlife hunted
- Mai Khlong Ungwa 2	+ Various community action	+ Crop for trade	+ Plain land	+ Irrigation system in area	+ complete forest area	+ Various wildlife
	- Culture interfered Solving	- Browbeat the crop Trade	- Wrong land use	- Mismanagement water resource	- Conversion forest to cultivate land	- Wildlife hunted
- Tai	+ Group strength	+ Various land use	+ Various land use	+ Water yield in Huai Mae Di Dam	+ complete forest area	+ Various wildlife
	- Thinking overpowered	- Browbeat the crop trade	- Encroaching other community land	- Mismanagement water in dam	- Converse forest to cultivate land	- Wildlife Hunted

Table 11 (Continued)

Village	Social	Economic	Environment			
			Soil	Water	Forest	Wildlife
- Khlong Salao	+ Community harmonious - Thinking overpowered	+ Wide cultivation area - Browbeat the crop trade	+ Soil fertilizer - Cultivation area was encroached from other community	+ Water yield and Stream - Stream bank was damaged	+ complete forest area - Converted forest to cultivate land	+ Various wildlife - Wildlife was hunted
- (Watershed)	+ Culture strict - dark authority cover - Bad behavior copy	+ Wide agricultural Land + Good cropping product - Browbeat the crop trade - Single crop	+ soil fertilizer - Mismanagement in soil resource	+ Stream and Huai Mae Di dam utilize - Mismanagement water resource	+ complete forest area - Conversion forest to cultivate land	+ Various wildlife - Wildlife was hunted

Note.

+ Positive situations - Negative situations

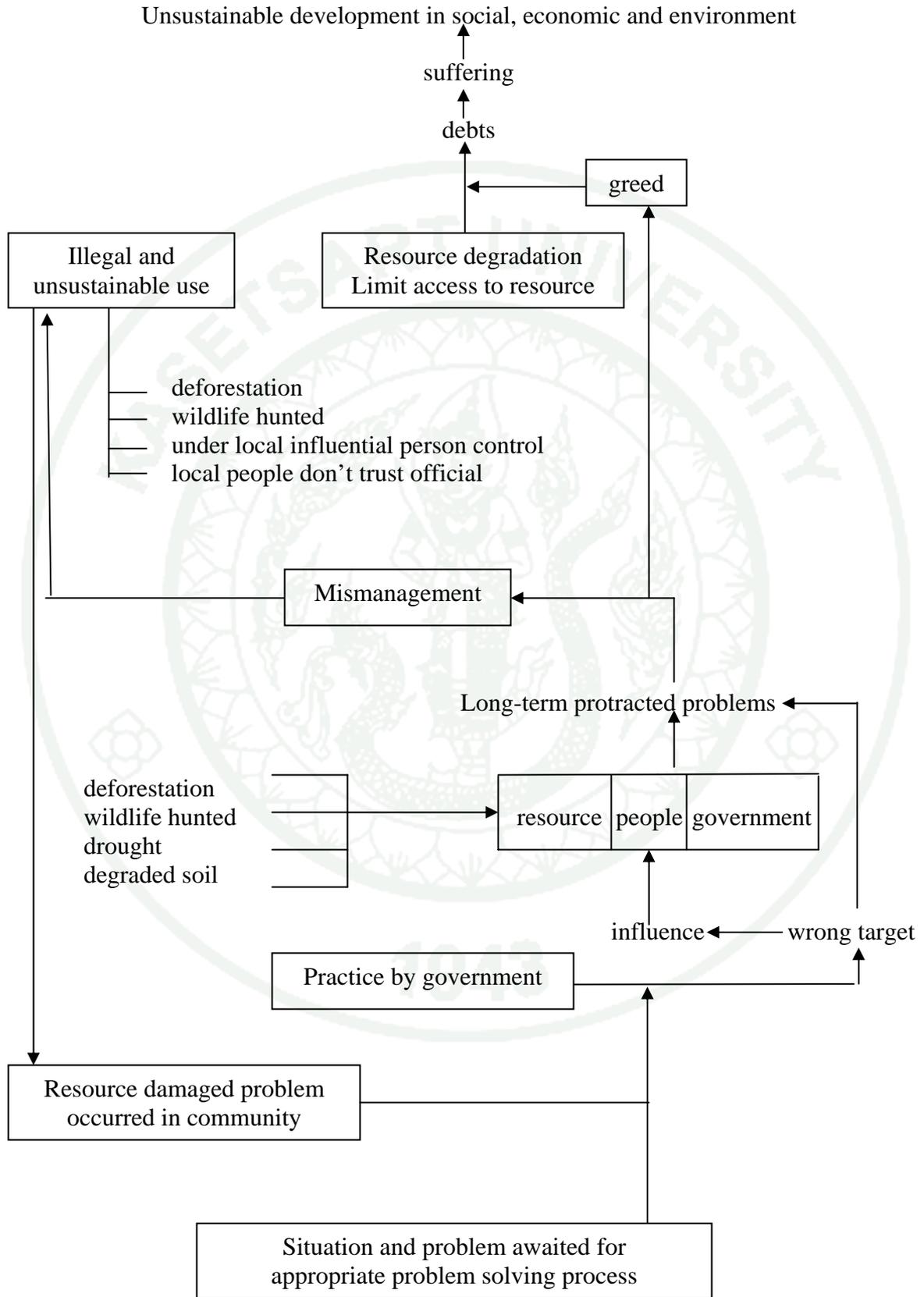


Figure 11 Problems-solving analysis in Huai Mae Di Noi Watershed

2. Development of problem solving procedure by participation

2.1 Pattern of problem solving procedure by participation

Problem solving procedure by participation consists of local participation and action. Problem identification is the first procedure to collect secondary data for participation planning.

Meeting with the local people to learn the situation and problem is the next step to gain the reliability resulted in getting participation of local people.

Discuss with 20 villagers individually in each village in order to gain the cooperation which is 75%. The outcome is the understanding of the local in problem management.

Then action procedure in natural resource and environment is provided by watershed analysis. All villagers participated in this activity because of their benefit in area zoning between community area and forest zone. In addition, they aware of illegal forest invasion.

For social clarification, merit activity is set in every village. 80% of villagers attend this activity but the other 20% cannot participate because they are busy with their occupation. For more participation, meeting for the leader is set to explain the reason for participation. So the participation result is 100%. All leaders were aware of cooperation.

In order to prepare the procedure, the training is arranged for 130 villagers. Various knowledge in social, economics and environment is transferred to the participants. The main factor in participation is motivation in problem solving for the local community. The training aims for cooperation, cultural conservation, occupation development and reforestation.

After the training, knowledge is transferred to other villagers by discussion with individual villagers. 75% of the trainees transfer the knowledge to others, whereas the rest use the knowledge in action i.e. planting different kind of trees for biodiversity conservation and occupation expansion.

After knowledge transformation, the area zoning between working area and forest is identified. This action participation is 100%. Every area is clarified the temporary land zoning. The main reason for this participation is demand in working area. In order to establish the stability in the local community, training for understanding and awareness is set in the local villager. This activity gains 75% participation. The 25% rest cannot attend the activity because of their career.

The participation of social, economics and environment management is turned into the actions for 1 year. These actions are culture conservation, multiple-agriculture and reforestation. Seventy percent, of villagers in Ban Yang Daeng use the knowledge in management for 1 year. The outstanding result is conservation of culture. Sixty percent, of villagers in Ban Mai Khlong Ungwa1 take action in multi-occupation. Since their location is near water resource, villagers can plant various kinds of trees i.e. fruit tree, banana, upland rice. Fifty percent, of villagers in Ban Mai Khlong Ungwa 2 take care of environment in the village and plant tree in their own area. 45 % of the villagers change

their agriculture into mix-cropping and reduce the chemical fertilizer. Fifty percent, of the villagers in Ban Khlong Salao plant trees between working area and forest area. In average, the participation in the watershed is 55%. However, this participation is done by the arbitrary with no rule, therefore participation is set for 5 villages and watershed and gain 85% contribution.

Next activity is public hearing to gain problem solving pattern for the local. The result is found that problem solving in each village depends on situation. Working in cooperation is more powerful than individual action. This activity gains 90% participation and applies the data from all activities above. Therefore, 46 groups are set as shown as follows (Table 12)

- Conservation and development group. This consists of 5 groups for 5 villages. 113 members are the representatives of the village. Each group has its own leader. The aims are for sustainable natural resource and environment management in 4 main categories: soil, water, forest and wildlife.

- Conservation and development network group. Kao Ma Oui is the network for conservation and development in the watershed. The committees are set to take responsibility without the budget for establishing in understanding and relating the activities in natural resource conservation and development.

- Action groups were set according to their name. There were consist of water user group, conservation tourism group, herbal conservation group, mountain-forest-wildlife conservation group, working area development group, sustainable occupation development group and occupation promotion group.

In sum, the responsibility of each group is for natural resource and environment management, occupation development and social management. The procedures for problem solving consist of 4 patterns which are discussion, public hearing, training and field trip.

The procedure can be concluded as follow:

First, meeting with the villager is set in order to learn the situation and problem and to gain their participation. Next, individual villager from every village is discussed to establish the participatory problem solving process. After the understanding, action is taken place in natural resource and environment management by watershed survey. Social and merit activity are set. Then meeting with the leader is arranged to provide the facilities necessary in participation. The representatives of the villages are trained to transfer the knowledge to other villagers. Area zoning between working area and forest are identified. The training for all villages is arranged to take action in social, economics and environment management. The action is processed for 1 year. After that, the meetings in 5 villages and in the whole watershed including the public hearing are set in order to find the pattern for problem solving. 46 groups are established to encourage people's participation in problem management.

Each organization relates to one another and bases on natural resource usage which are soil, water, forest, wildlife and culture are as follow:

Table 12 Community organizations

Village	Community organization / Staff (persons)										Note.
	DCG.	HCG.	HFWCG.	SCG.	RDG.	LDG.	CDG.	WUG.	ECG.	CPSG.	
Yang Daeng	18	6	25	5	12	-	-				Y.
Mai Khlong Ungwa 1	18	4	14	4	-	39	10				M.(1)
Mai Khlong Ungwa 2	30	6	14	5	-	20	14				M.(2)
Tai	5	6	8	6	-	55	10				T.
Khlong Sa Lao (Watershed)	42 20	8 -	22 -	11 -	- -	102 -	18 -	15	15	8	K.
Total	133	30	83	31	12	216	52	15	15	8	

Note.

1. DCG.Y. is Ban Yang Daeng Development and conserved group. 2. HCG.Y. is Ban Yang Daeng Herb conserved group. 3. HFWCG.Y.(L) is Ban Yang Daeng (Left) hill-forest-wildlife conserved group. 4. HFWCG.Y.(R) is Ban Yang Daeng (Right) hill-forest-wildlife conserved group. 5. SCG.Y. is Ban Yang Daeng stream conserved group. 6. RDG.Y. is Ban Yang Daeng rotation cultivation developed group. 7. DCG.M.(1) is Mai Khlong Ungwa 1 Development and conserved group. 8. HCG.M.(1) is Ban Mai Khlong Ungwa 1 Herb conserved group. 9. HFWCG.M.(1)L is Ban Mai Klong Ungwa 1 (Left) hill-forest-wildlife conserved group. 10. HFWCG.M.(1)R is Ban Mai Klong Ungwa 1 (Right) hill-forest-wildlife conserved group. 11. SCG.M.(1) is Ban Mai Khlong Ungwa 1 stream conserved group. 12. LDG.M.(1)L is Ban Mai Khlong Ungwa 1 Huai Ungwa (Left) land use developed group. 13. LDG.M.(1)R. is Ban Mai Klong Ungwa 1 Huai Ungwa (Right) land use developed group. 14. CDG.M.(1). is Ban Mai Khlong Ungwa 1 career development and encouraged group. 15. DCG.M.(2) is Ban Mai Khlong Ungwa 2 Development and conserved group. 16. HCG.M.(2) is Ban Mai Khlong Ungwa 2 Herb conserved group. 17. HFWCG.M.(2)L is Ban Mai Klong Ungwa 2 (Left) hill-forest-wildlife conserved group. 18. HFWCG.M.(2)R is Ban Mai Khlong Ungwa 2 (Right) hill-forest-wildlife conserved group. 19. SCG.M.(2) is Ban Mai Khlong Ungwa 2 stream conserved group. 20. LDG.(T-D) is Tambon – Dam land use developed group.

Table 12 (Continued)

Note.

21. LDG.(H-W) is Huai Kanoon – Wad land use developed group. 22. CDG.M.(2) is Ban Mai Khlong Ungwa 2 career development and encouraged group. 23. DCG.T. is Ban Tai Development and conserved group. 24. HCG.M.T. is Ban Tai Herb conserved group. 25. HFWCG.T. is Ban Tai hill-forest-wildlife conserved group. 26. SCG.T. is Ban Tai stream conserved group. 27. LDG.(L-C) is Left part – Check point land use developed group. 28. LDG.(R-C) is Right part – Check point land use developed group. 29. LDG. (KY) is Khao Yai land use developed group. 30. CDG.T. is Ban Tai career development and encouraged group. 31. DCG.K. is Ban Khlong Salao Development and conserved group. 32. HCG.M.K. is Ban Khlong Salao Herb conserved group. 33. HFWCG.K.(L) is Ban Klong Salao (Left) hill-forest-wildlife conserved group. 34. HFWCG.K.(R) is Ban Khlong Salao (Right) hill-forest-wildlife conserved group. 35. CG.K. is Ban Khlong Salao stream conserved group. 36. LDG.(NK) is Huai NoK Kok land use developed group. 37. LDG.(MN) is Huai Mae Di Noi land use developed group. 38. LDG.(HM) is Huai Ma Naow land use developed group. 39. LDG.(CP) is Central part land use developed group. 40. LDG.(UP) is Upper part land use developed group. 41. LDG.(LP) is Lower part land use developed group. 42. CDG.K. is Ban Khlong Salao career development and encouraged group. 43. DCG(N). is Khao Ma oui Development and conserved Net work. 44. WUG. is Water usage group. 45. ECG. is Ecotourism group. 46. CPSG. is Career development pilot base on sufficiency economy group

Every group was established in 2005 except the Career development pilot base on sufficiency economy group (CPSG.) in 2006

2.1.1 Natural resource and environment management.

Natural resource and environmental management is divided into forest, soil, water and wildlife as shown in Figure 12.

1) Forest management

Mae Dee Noi Watershed has 90% abundant forest area and the other 10% is changed into agricultural area and community. Forest management in each village is different due to the topography.

(1) Forest Management in Ban Yang Daeng

Ban Yang Daeng is located in the upmost area of Khlong Unwa stream of Mae Dee Noi Watershed. The community is situated 3 kilometers from the highest point of the watershed. 14,000 rai of forest area is in the village zone. The highest point is in the east of the community. Wood is used according to the necessary in daily living (Table 13) and based on culture. So the community can conserve forest very well. This has an effect on the village downstream. The upstream is well preserved and there is water in the stream all year round. Map indicating the natural resource and environmental management in Ban Yang Daeng is shown in Figure 13.

Forest management in Ban Yang Daeng is unique as follow:

- Forest Usage

Forest usage is divided into 3 characteristics. Wood used for dwelling and living is from big tree i.e. *Melia azedarach* L.s., *Gmelina arborea* Roxb. in rotation crop land. Fast growing tree is used to fix house which is small and primitive. Bamboo is used for house floor and wall. Herb is also necessary for the village. Herb usage is 144 plant/house/year. Village has arranged the area of 200 rai for herb conservation. Furthermore, herb is collected from rotation crop land and stream bank. These are *evecta*, *rasemosa*, and *Stephania venosa*.

It can be concluded that the main forest usage is from wood, bamboo and herb. 30 tree boles, and 120 culms of bamboo are used per house per year. Herbal usage is more than the other villages.

- Forest prevention

Forest prevention is from cultural ceremony which is holly forest in the highest peak of the watershed (1,390 meters) and also around the top of mountains.

The local set the organization to take care of resource in the community. Knowledge is transferred to next generation. When there is forest invasion from the other people, the villagers will prohibit them with the cooperation with related organization. Therefore, the local can protect forest efficiently.

- Reforestation

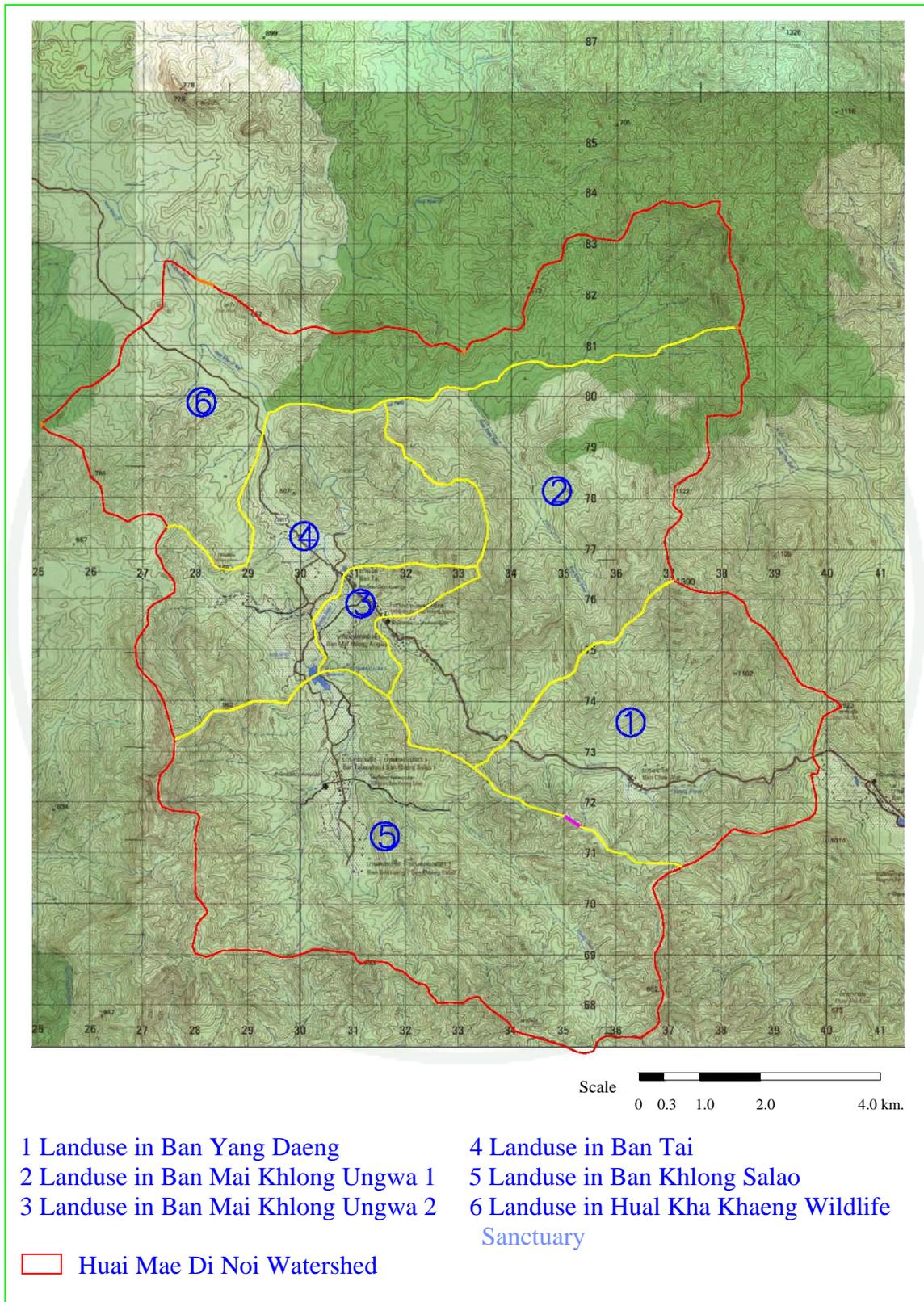


Figure 12 Landuse in Huai Mae Di Noi Watershed

Source: Modified from Royal Thai Survey Department (1972)

Table 13 Forest resources utilization in Huai Mae Di Noi Watershed Ban Rai district, Uthai Thani province

No.	Type of usage	Forest usage Quantity / Household					Note.
		Ban Yang Daeng	Ban Mai Khlong Ungwa1	Ban Mai Khlong Ungwa 2	Ban Tai	Ban Khlong Salao	
1	Residence	tree 30 logs bamboo 120 culms	tree 25 logs bamboo 80 culms	tree 24 logs bamboo 85 culms	tree 35 logs bamboo 70 culms	tree 40 logs bamboo 90 culms	
2	Fuel	36 pieces	30 pieces	25 pieces	30 pieces	40 pieces	
3	Herb	144 clumps	84 clumps	80 clumps	120 clumps	120 clumps	
4	Material to use	Tree 1 log bamboo 24 culms	tree 2 logs bamboo 30 culms	tree 3 logs bamboo 24 culms	tree 5 logs bamboo 16 culms	tree 2 logs bamboo 15 culms	
5	Worship	12 pieces	12 pieces	12 pieces	16 pieces	15 pieces	
6	Others	12 pieces	6 pieces	10 pieces	50 pieces	90 pieces	

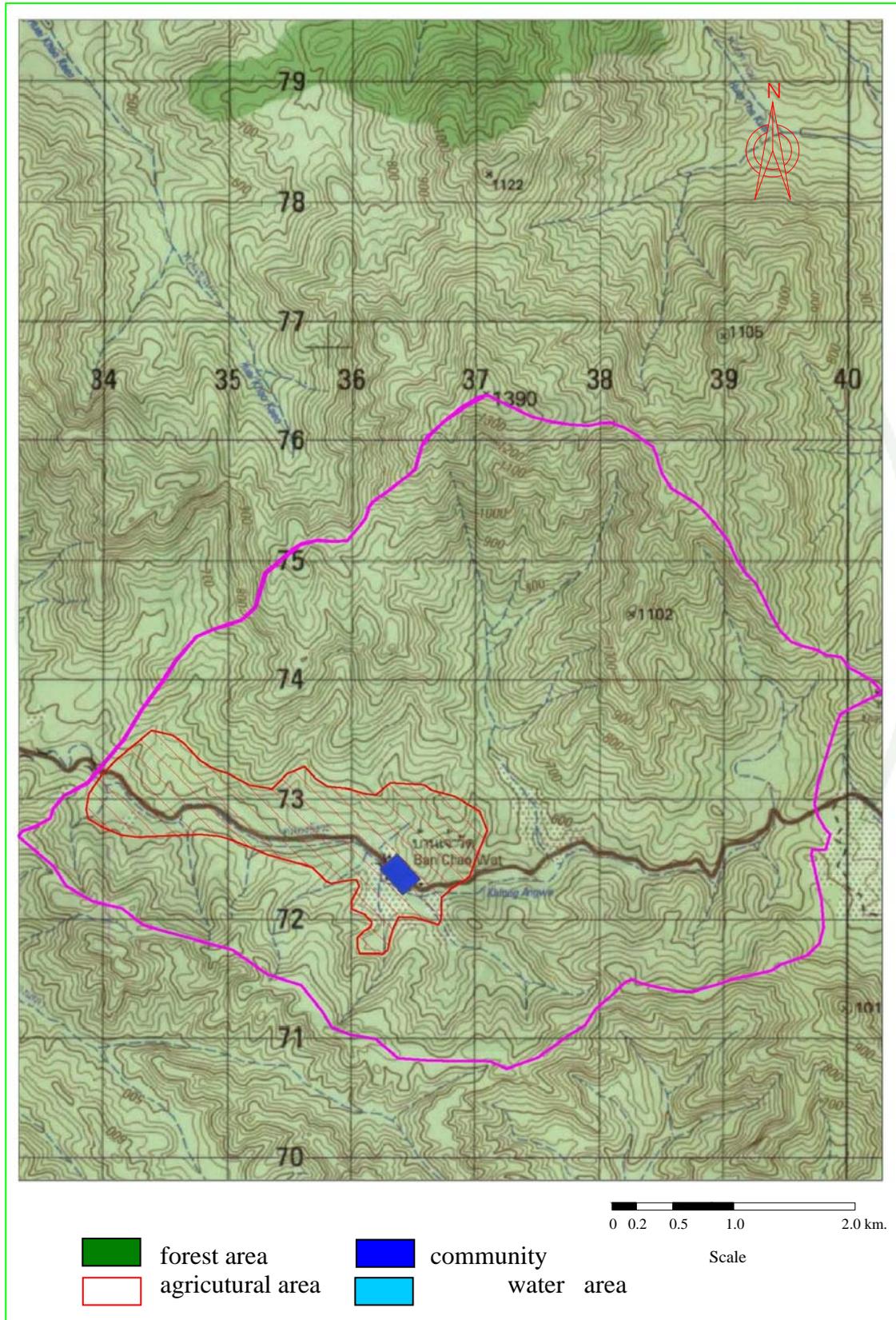


Figure 13 Natural resource and environment management area in Ban Yang Daeng

Source: Modified from Royal Thai Survey Department (1972)

The deforestation in this village occurs along the road sides and some is caused by forest fire especially bamboo forest. Repetitive land use can cause soil degradation. Reforestation was done with wooden tree and fruit tree. Mixed cropping and reforestation are its way to recover the area.

- Forest fire prevention

Forest fire occurs in 2 areas of the community. One is along the road sides and the other is in the natural forest far away from the community but next to the forest area of the other villages. Forest fire is protected only in the area near the community by buffer zone. For the other areas, there is cooperation with other organization.

- Management for special forest

The local people live with the nature for many years. Conservation trend from the outside inspires the villager in behaviour. Special forest is reserved for tourism and learning centre. Therefore, forest is well managed in 4 areas: Ungwa stream bank, the most upstream and downstream of the community (250 rai). The total area of special forest is 1000 rai.

(2) Forest management in Ban Mai Khlong Ungwa 1

Ban Mai Khlong Ungwa 1 is located 5 km downstream of Ban Yang Daeng. This village is on both sides of stream bank. The area is steep slope. Agricultural area is along stream bank. Forest is mostly converted into the agricultural land except on the mountain ridge. The abundant forest area in this community is 17,875 rai. Forest next to the agricultural area is invaded by some villagers. Map indicating natural resource and environment management in Ban Mai Khlong Ungwa1 is shown in Figure 14.

Patterns of forest management in Ban Khlong Ungwa 1 are as follow:

- Forest usage

Villagers have settled their houses permanently since 2001. Hard wood i.e. *Xylia xylocarpa* (Roxb.) Taub. var. *Xylia Kerrii* (Craib & Hutch) I.C. Nielsen., *Plerocarpus Indicus.*, *Shorea obtusa* Wall. ex Blume), *Shorea siamensis* Miq. is used for dwelling construction. Trees are illegal cut in the area above Huai Mae Dee reservoir. Bamboo usage for house is decreased but the amount for living is the same. Herb usage is also decreased because of modern medicine and smaller numbers of person who have herbal knowledge. The pattern of forest usage is individual use but sometimes help each other to gain the labor.

- Forest prevention

Forest area of this village is connected from the agricultural land up to the watershed divide of Mae Dee Noi (Ungwa stream). It is abundant on the steeply slope and high mountain. The local prevent the resource by zoning the responsible area. Leader is voted to take care of both areas. Members who have their own land participate in forest prevention. The path along the divide is surveyed once a month and every Sunday during dry season to prevent the forest.

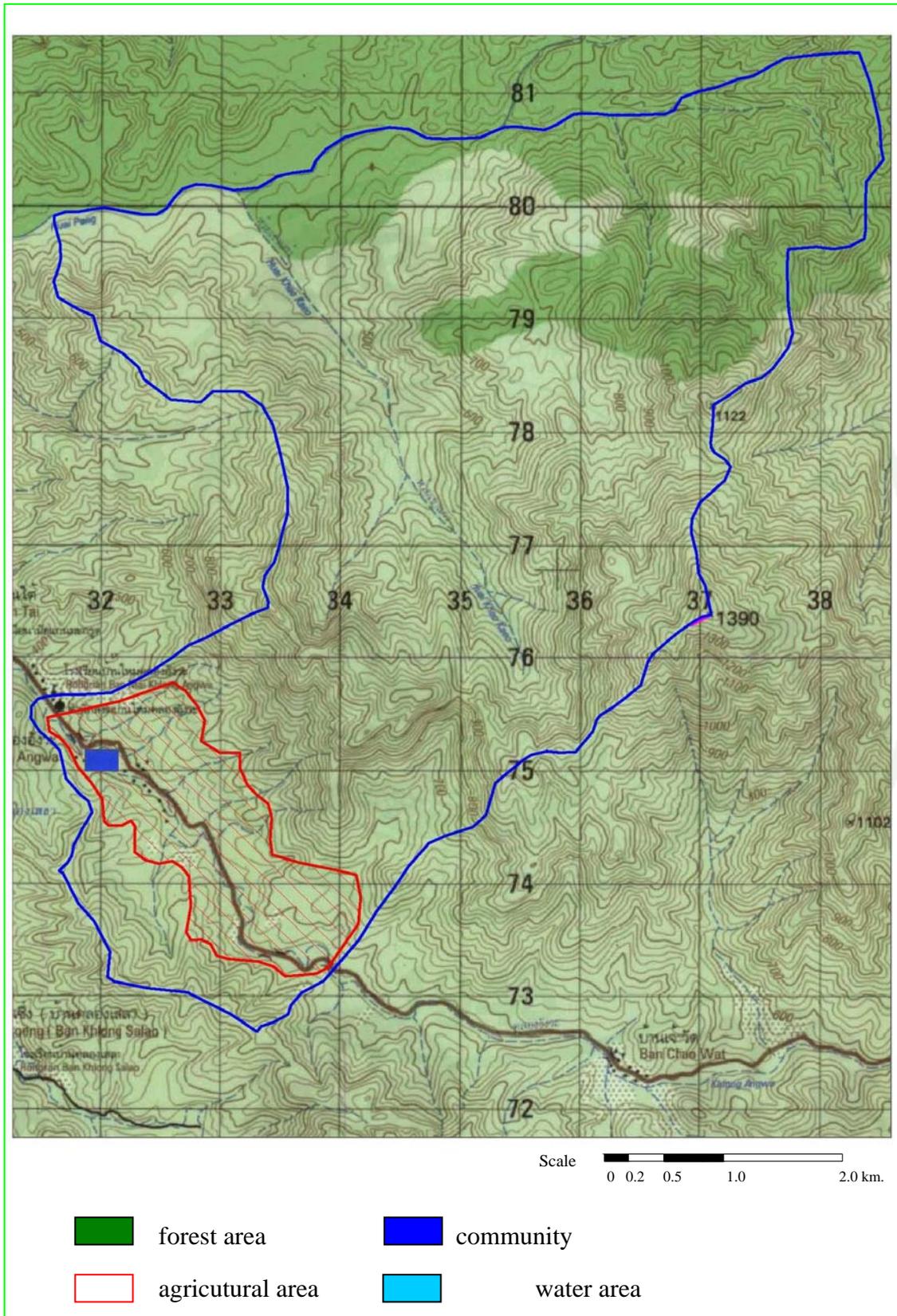


Figure 14 Natural resource and environment management area in Ban Mai Khlong Ungwa 1

Source: Modified from Royal Thai Survey Department (1972)

- Reforestation

One factor affecting on deforestation is forest fire that occurs every year on the high mountain with dense glass cover in the east and forest invasion for agriculture. Reforestation is managed by mix crop planting i.e. banana, fruit tree and tall tree. This planting pattern is change by the market prize. Moreover, villagers plant fast growing tree i.e. *Ficus benjamina*. Therefore, reforestation is 40% of the disturbed area.

- Forest fire prevention

There is a centre of forest fire prevention in this community. Many villagers are the officers in this unit so they know how to prevent the forest fire and can transfer to other villagers. However, forest fire still occurs every year because of the topography of steeply slope and dry dipterocarp forest. Fire break is established along the agricultural area next to the forest and forest fire officers have been set since 1997.

- Management for special forest

This community interested in the tourism because of conservation tourism trend. So the local community arranges two beautiful recreational areas. One is on the right of the village or in the east along the mountain divide and Khao Lang Na where the magnificent scenery below can be seen and forest is abundant. The other is on the left side of the village or in the west with less slope and long divide. Beautiful scenery can be seen on both sides of the mountain and several big trees are found i.e. *Plerocarpus Indicu.*, *Afzelia xylocarpa* (Kurz) Craib. The local community participates to arrange these areas for conservation tourism. One leader and 8 committees are assigned to take care of this.

Overall, the local people can manage forest resource in Ban Mai Khlong Ungwa 1.

(3) Forest management in Ban Mai Khlong Ungwa 2

Ban Mai Klong Ungwa 2 is located between Ban Mai Khlong Ungwa 1 and Ban Tai. This village has more prosperity than the others. There are temple, school, public health care station, Kaen Ma Krood municipality and shops. Forest area in this community is less than the others. 875 rai of forest is in the east next to Khlong Ungwa temple up to forest area in Ban Mai Khlong Ungwa 1 and in the west of the village up to Ban Khlong Salao. The forest condition is abundant except the converted area into agriculture and forest area connecting to agricultural land. Map indicating natural resource and environmental management in Ban Mai Khlong Ungwa 2 is shown in Figure 15.

Patterns of forest management in Ban Khlong Ungwa 2 are as follows:

- Forest Usage

The local people imitate houses like the low land villages and there is shop in the village. Wood is used for house construction according to the necessary without law consideration. This wood is from natural forest in the local area and nearby. Big tree in the forest is reserved by each family without fighting. Tree is usually cut during dry season as it is similar to the area when leaves are dry and then transferred to the village at night.

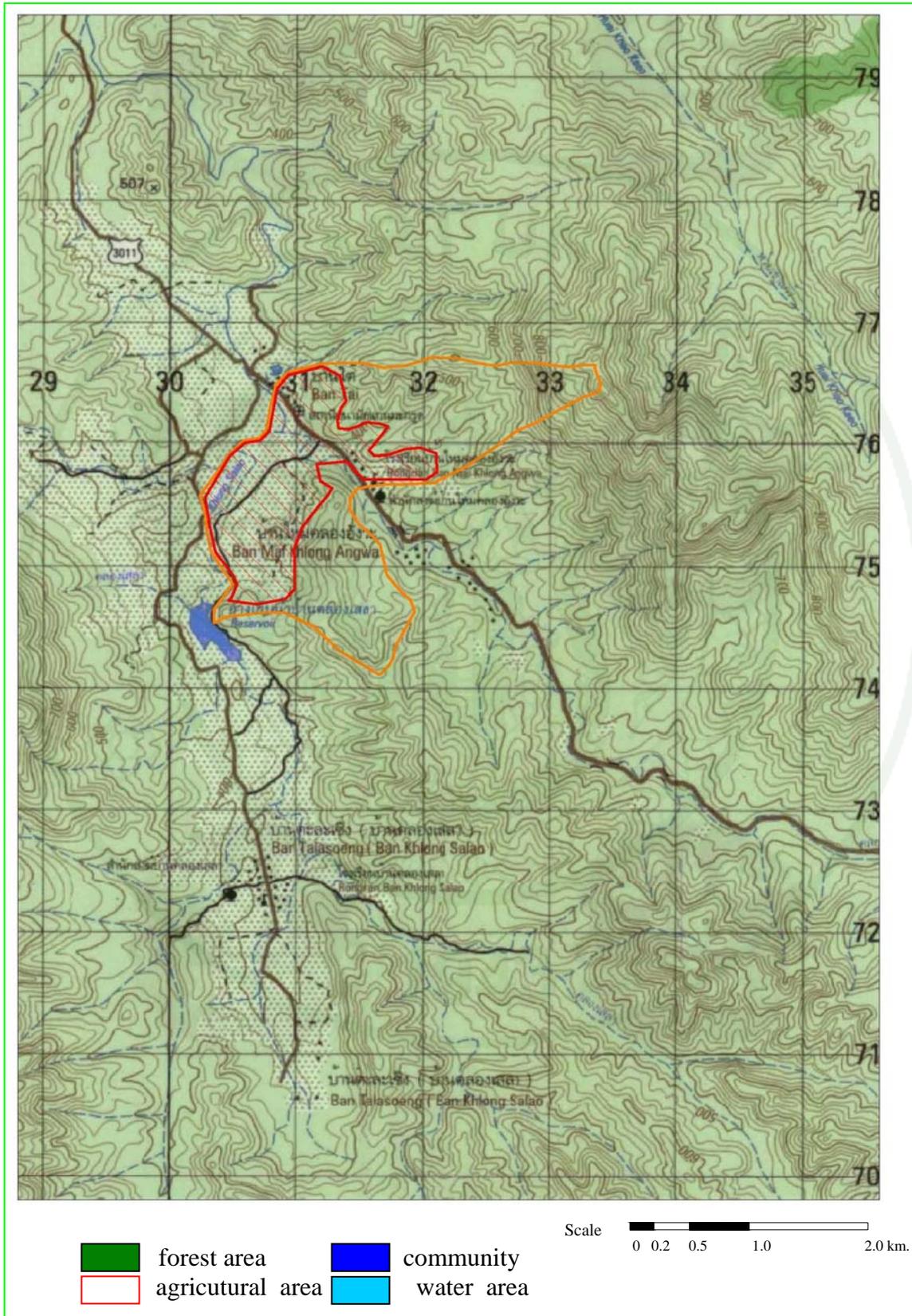


Figure 15 Natural resource and environment management area in Ban Mai Khlong Ungwa 2

Source: Modified from Royal Thai Survey Department (1972)

Bamboo is taken from forest behind Khlong Ungwa temple to use for living thing i.e. basket. Pattern of wood usage in this village is not strict.

- Forest prevention

Ban Mai Khlong Ungwa 2 is the largest village in the watershed with the least forest area. Forest prevention is effectively. There is no invasion from other neighbor. Factor affecting on forest prevention is village leader who is strict. So the villagers participate in the activities because of their love in resource which is less than the other villages. Furthermore, priests are able to persuade the local people in forest prevention.

- Reforestation

Villagers realize of deforestation and single crop planting and participate in reforestation by indicating the reforest area and activities. Long live trees have been planted along agricultural land and stream bank since 1915. To recover the forest fire area, the local people separates the responsibility area and boundary. Reforestation is 20%.

- Forest fire prevention

According to the strong leader and small number of villagers, forest fire prevention is effective. Fire break is established around the village next to the forest and along the divide. The result of forest fire prevention is around 80%

- Management for special forest

This community has set the beautiful area for conservation tourism. This is in the forest area of Huai Mae Dee Noi adjacent to Ban Khlong Sa Lao. The villagers have set the organization to take care of this special area.

There are 2 types of forest management in Ban Mai Khlong Ungwa2. The leader is interested in conservation. Therefore, this community can reserve its abundant forest and participate in reforestation.

(4) Forest management in Ban Tai

This community is adjacent to Ban Mai Khlong Ungwa 2. There is boundary next to Huai Kha Khaeng wildlife sanctuary and Ban Khlong Salao. There is 25,000 rai of forest but small number of population. The forest is abundant around the community and scattered in various forest groups. Map indicating the natural and environmental management is shown in Figure 16.

Patterns of forest management in Ban Tai are as follows:

- Forest usage

Control forest area in the community is in the east and north of the working area especially in the north that connects to Huai Kha Khaeng wildlife sanctuary

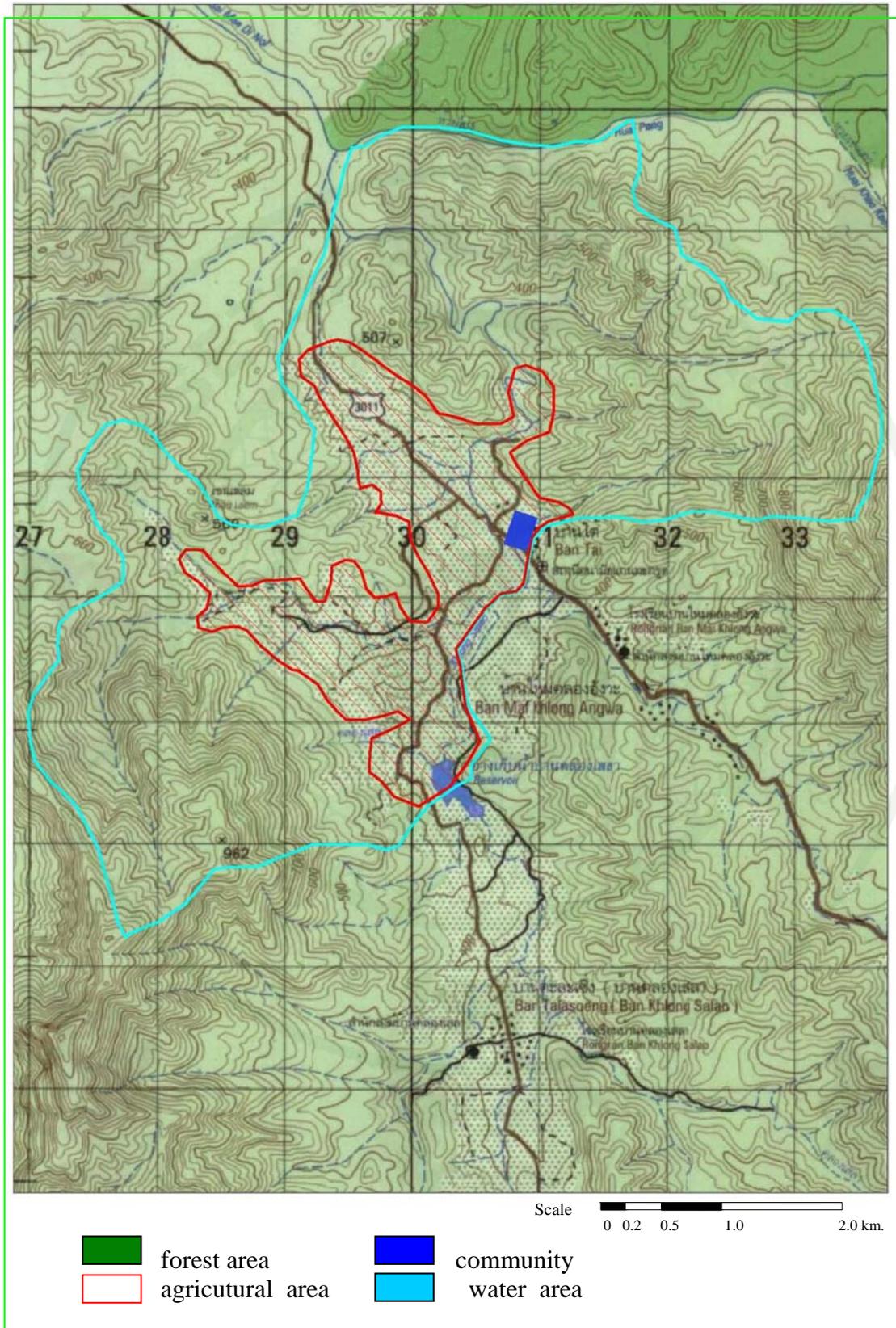


Figure 16 Natural resource and environment management area in Ban Tai

Source: Modified from Royal Thai Survey Department (1972)

which is the buffer zone. Forest usage is mostly from the buffer zone because of various kinds of plant in low land. 25% families build another house in their working area causing more use of bamboo and wood. However, there are plenty of trees left. Some area of forest is disturbed and converted into agricultural land. After burning the forest, the villagers invade 25% of area along the boundary between working area and forest. In addition, this community uses more herb than the others except Ban Yang Daeng since there are many expert in herb especially the leader and elder. Herb is planted in the residence area and on stream bank.

- Forest protection

This area is based on laws as it is adjacent to conservation forest area. Forest protection by the local people is effective in the remote site. The villagers tend to use the deserted land next to the working area for agriculture. Only 25% of area can be protected.

- Reforestation

Forest is slightly disturbed, so it is recovered by nature. For disturbed area near the working land, the villagers recover the area around 10% by planting long life trees or fruit trees. Moreover, local forest is developed by cooperation to gain more green area.

- Forest fire prevention

Forest area which is bamboo and dry dipterocarp forest in the east of the community is prevented from fire by setting buffer zone between agricultural land and forest. When fire occurs, leader, villagers and officers will help to suppress it.

- Management for special forest

Forest area connecting to Huai Kha Khaeng wildlife sanctuary is specially managed by the local people. There is abundant forest and water flow in this area. So the community strictly conserve and manage this 3,000 rai for natural walk way.

Large area of forest in Ban Tai is well managed by the local people, but deforestation is still occurs along the connecting zone. However, the community has the forest recovery plan for both in working area and around the village.

(5) Forest management of Ban Khlong Salao

This community situated upstream of Mae Di Noi watershed is the most far away of Uthai Thani province. There are 2 streams flowing to Ban Mai Khlong Ungwa 2. Forest area covers 3 directions except in the east. 26,000 rai of forest is abundant up to the mountain ridge which is Huai Kha Khaeng wildlife sanctuary in the north and west. Map indicating natural resource and environment management is shown in Figure 17.

Patterns of forest management in Ban Khlong Salao are as follows:

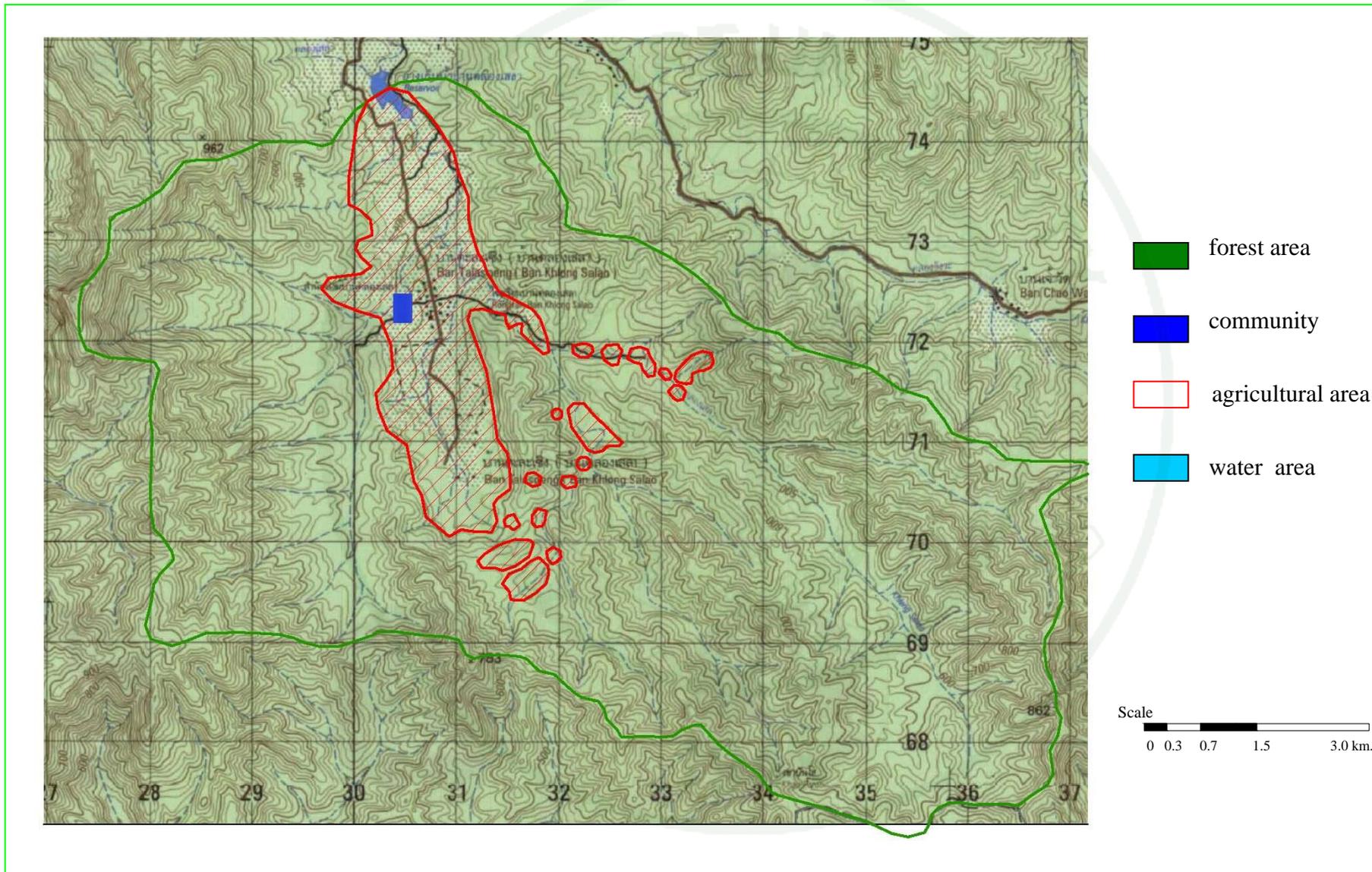


Figure 17 Natural resource and environment management area in Ban Khlong Salao

Source: Modified from Royal Thai Survey Department (1972)

- Forest usage

Wood usage from the south and west of the village is characterized into 2 groups. One is used for permanent house by wealth families and the other is used for temporary house. Forest in the north can not be used because the forest office is located here. There is no rule for wood usage from forest due to a large number of woods, a few officers and a remote area. Herb from forest is only gathered by 2% of villagers so there is still plenty of herb left.

- Forest protection

Two groups for forest fire prevention are established which are north groups (Khao Yai) and west to south group (Khao Hin Lom). There is an agreement not to invade the forest for agriculture but only 50% takes effect because of high price of product. So wood selling is guarded by all villagers.

- Reforestation

This community has larger working area than the others. In addition, there are villagers from Ban Tai come to work in this area. Therefore, forest is changed into agricultural area and Mae Dee Noi stream is disturbed along its way through the community. Bamboo, fruit tree and banana are planted along the stream to recover around 25% of forest. In the future, there is a trend to recover all forest area when villagers understand and aware of natural resource and environmental conservation. Natural forest is disturbed by forest fire in the steep area and recovered by nature without invasion. Some area is recovered by burying plant seed i.e. *Pterocarpus Indicus*, *Azelia xylocarpa* (Kurz) Craib.

- Forest fire prevention

Forest fire usually occurs in the west of the community as it connects to the long working land and forest of Suphan Buri province. 10% of forest fire is prevented even though fire break is set. This is because of forest disturbance.

- Management for special forest

The community set four conservation tourism groups to manage forest for future travelling. (1) Khao Yai area (4,000 rai) in the north with beautiful scenery, the highest point 1,151 meter above mean sea level, abundant forest and *Cycas circinalis*. (2) Khao Hin Lom in the south, the area of 500 rai with big stones allocated along the mountain ridge. (3) upstream of Huai Mae Dee Noi in the south, the area of 1,000 rai with old path along the divide to Suphan Buri and Kanchana Buri province, various trees i.e. *Azelia xylocarpa* (Kurz) Craib, *Pterocarpus Indicus*. and stream flow all year round (4) Khun Haui Nok Kok and Khun Huai Ma Nao in the west, the area of 1,500 rai next to Huai Kha Khaeng wildlife sanctuary with remote scenery, abundant wildlife and forest, 200 rai of agricultural land in the valley which can be developed for agricultural tourism.

Forest management in Ban Khlong Salao can effectively reserve big forest. Disturbed area is recovered from single crop to mix cropping.

Forest management for the watershed with 90% of forest is affected by various factors such as the adjacent area to conservation forest, a small number of population, way of lives that is far away from civilization and depends on nature. However, the community arranges the organization for resource management to follow the social adaptation.

Soil, water and wildlife management in this watershed is similar, only small detail was different according to the topography and way of lives in each village as follow:

2) Soil management

Land in Huai Mae Dee Noi watershed is abundant as some area has recently changed from forest to agricultural land and most area is forest. Pattern of soil management by each community is not much different:

(1) Land use zoning

Land management in the watershed is identifying the main areas: working and forest area. Problem is found only the connecting area. Every community prefers its obvious boundary. Only Ban Yang Daeng clearly defines rotation crop boundary with no forest invasion. Only 40% of zoning take effective.

(2) Agricultural land preparation

Soil in agricultural land is recovered by vegetation waste without burning in order to reduce chemical fertilizer and area is tillage along the terrace for instance in Ban Mai Khlong Ungwa 2. Soil surface is left for 3 month for agriculture preparation. After cultivation, land is prepared next year. Only Bang Yang Dang prepares rotation crop land around 2-5 rai/plot by burning vegetation waste and grass. After 1-2 years of planting, land is left for 5-8 years to recover.

(3) Soil management for planting

During planting, soil is fertilized by grass cover and vegetation fertilizer. For large agricultural area, a large amount of chemical fertilizer is used. The local people understand that this way can degrade soil fertilization but it is a convenient method and there is no consideration of other solution.

(4) Land management after cultivation

After cultivation, there are 2 characteristics of management to improve soil properties: (1) the area is left naturally without any procedure, only forest fire is prevented, (2) various kinds of short life plant i.e. peanut are planted in order to fertilize soil. The second method is only 20%.

(5) Land management in natural forest

Land in natural forest is managed in parallel with forest management. Forest conservation affects undisturbed soil and abundant plant.

Soil resource in the watershed is managed by the local people. Land with high activities like agricultural area has an effect on land use change. In overall, soil in this watershed is abundant.

3) Water management

The watershed is abundant according to soil, water, forest, wildlife and behavior of the villagers. For water resource, there is natural and man made water sources. Natural water sources are main stream, substream and return flow with flow throughout the year. Organization is arranged to take care of water source. Holy area in the upstream is set to maintain the water resource. For man made water source like pond, reservoir and fish pond, the organization has a responsibility to manage it. 50% of management is effective.

4) Wildlife management

Because of large forest area and connection to Huai Kha Khaeng wildlife sanctuary, plenty of wildlife is found in the watershed. Each community has similar way of management. Direct way of management is protection for wildlife hunting. Indirect way is promoting supplementary occupation i.e. frog, fish and chicken farm for the local people to gain more income and food without wildlife hunting. Forest conservation is also indirect way to preserve the habitat and food of wildlife. Organization is established to develop wildlife management.

2.1.2 Social management in Huai Mae Di Noi watershed

Participation process has been set up for 6 years from 2002-2008. It is found that social condition in 5 communities has been changed. At first, the villagers had cooperation and no fighting. There was travelling between the villages without using car so they can meet and rest for a long time. During 2003-2004, price of agricultural product increased, the villagers could buy motorcycle as it is a new thing for the villages. This caused an accident and unexpected result in relationship between the communities. Finally, rules have been set to gain mutual aids, nowadays the local people is strong and has social activities to preserve the culture.

Social activities in Huai Mae Di Noi watershed can conserve various resources as these activities related to the nature both in direct and indirect way are passed on by each generation and mixed with Buddhism as follow:

1) New Year ceremony

New year of Karen hill tribe is on Songkran day the same as Thai New Year. Leaders from other areas are invited to join the ceremony. The younger will ask for forgiveness from the elder. Working generation arranges for food and welcomes guests. This culture can be reserved for a long time as there is no strict rule and it can be done along with other Buddhism activities.

2) Age extension

It is an annual ceremony after the New Year ceremony. Everyone has to participate it or family has to do for the absent one. Big tree along the stream bank is a place for this service. The area is cleaned, bridge is constructed to cross the stream, 2 pagodas are built near the tree and bridge. 2-4 meter long bamboo and water container are prepared for every member in a family to hold the tree. The leader will pray to ask for forgiveness and blessing.

3) Ghost feasting

This ceremony is to discard bad things and make everyone happy. Every family prepares 2 sets of food. During the ceremony, everyone must be at home and turn off light in the village. The leader will take food to 2 defining points and come back to the ceremony place in the middle of the village. Darkness and silence are required to feast ghosts so they will not disturb the villagers. This culture can be transferred if the one who knows the ceremony process is yellow thread Karen.

4) House closing ceremony

This ceremony will be arranged when bad thing happens in the village i.e. illness, natural disaster. Every family prepares the candles as much as their family's member and takes them to the meeting point. The leader will pray and everyone lights the candles. This service takes place during the night. Ban Khlong Salao has this latest ceremony after Songkran day in 2006 because of quarrel during New Year ceremony and there was lighting in the middle of the village. After house closing ceremony, the situation is better.

This ceremony is uncertain in term of time as it depends on the event of the community. So it is not sure how long it will be preserved.

5) Ceremony for mother of land

This ceremony takes place every year in the beginning of January after rice cultivation. New rice and side dishes are gathered in the middle of the village. Villagers make merit and have meal together.

The sustainability of this ceremony depends on rice planting and occupation promotion by the government. If they can earn more salary by other careers, the ceremony may disappear.

6) New rice ceremony

New rice ceremony is held after rice cultivation each year. Having new rice for the first meal with special side dishes i.e. crab, shrimp from the stream is believed that the villagers will be diligent and have many children like animals that are their food. The neighbors are invited to join the meal. In addition, this meal is also prepared for the field instruments. This ceremony for each family will not be set in the same day because the villager can join the neighbor's ceremony.

The sustainability of this ceremony is like ceremony for mother of land but it may last longer because it is family's ceremony.

7) Pagoda respect

Pagoda respect is only the ceremony in Ban Yang Daeng since there is a religion leader who retains the soul. There is pagoda building for the respect every religious day. Everyone in the village will cease its own mission and participate in the ceremony for a whole day. In the evening, they talk only good thing and they have meal together. During the day, pagoda is cleaned and paid respect by flower, candle. Around 10 people from other villages will participate this service.

The sustainability of this ceremony depends on the religious leader.

8) Cropping ceremony for god

Cropping ceremony for god lasts for a long time but it is deserted for 10 years and then recovered again to maintain this good service. Area of 2-5 rai is cropped for god. It consists of land preparation, planting and maintenance without harvesting as it is left for god and animals.

The sustainability of this ceremony depends on the sacrificing of the local people.

9) Loy Kra Thong ceremony

Loy Kra Thong ceremony is set on the full moon day of twelfth month like other places but there is a different in the original aims. Worship for god is arranged near stream to ask for honesty. The leader is a priest who floats the “Kra Thong” first and the villagers will participate. The local performance is then displayed. Nowadays, every village arranges this service in Ban Tai where Hui Mae Di Noi meets Hui Kanoon.

The sustainability of this service is related to Buddhism and enjoyable performance and can be applied to the ages.

10) Land reservation ceremony

Land reservation ceremony is only in Ban Yang Daeng because of the rotation crop. The villagers reserve the land by agreement. If there is no bad dream after reservation, they will be successful in cropping. For the other communities, the rotation crop is changed into repetition cropping in the same area, so there is no land reservation ceremony. Since 1982, the government has arranged the land for individual family but there still was the rotation crop in the outside area. In 2000, the government does not allow the land invasion anymore.

The sustainability of this ceremony depends on land reservation in Hui Mae Dee Noi area. It can last long if Ban Yang Daeng can maintain this traditional condition.

In overview, the sustainability of culture in Karen hill tribe relates to Buddhism. Many ceremonies depend on faith and strength of religion.

Results of social management in Hui Mae Di Noi Watershed Ban Rai district, Uthai Thani province are shown in Table 14.

Table 14 Social management in Huai Mae Di Noi Watershed Ban Rai district, Uthai Thani province

No.	Social Activities	Results	Communities or villages	Note.
1	New year ceremony	Joint and cooperation in village	Every community	
2	Age extension	Grouping in each community was strength	Every community	
3	Ghost feasting	Happiness in community	Every community	
4	House closing ceremony	Happiness in community	Every community	Bad thing happens
5	Ceremony for mother of land	Joint and cooperation in village	Every community	
6	New rice ceremony	Peoples in community have to sacrifice.	Every community	
7	Pagoda respect	Peoples in community have to sacrifice.	Ban Yang Daeng	Community has pagoda
8	Cropping ceremony for god	Peoples in community have to sacrifice.	Ban Mai Khlong Ungwa1	Worship lost
9	Loy Kra Thong ceremony	Joint and cooperation for village developing.	Every community	
10	Land reservation ceremony	Original knowledge or wisdom has reserved	Ban Yang Daeng	Rotation cultivation

2.2 Problem solving by participation development.

Four processes which were discussion, public hearing, training and fieldtrip had been arranged in order to consider the situations and problems in the watershed area. The data in table 11 was used in 4 processes to find out management alternatives are as follows:

2.2.1 Discussion

Based on the discussion with individual villages, participation watershed management was proposed. From 25 villagers in Ban Yang Daeng, 22 of them had the same opinion for management alternative for solving the problems.

From discussion with individual villages, participation watershed management was proposed. From 41 villagers in Ban Mai Khlong Ungwa 1, 35 of them had the same opinion for alternative management for the problems.

From discussion with individual villages, participation watershed management was proposed. From 76 villagers in Ban Mai Khlong Ungwa 2, 68 of them had the same opinion for alternative management for the problems.

From discussion with individual villages, participation watershed management was proposed. From 39 villagers in Ban Tai, 35 of them had the same opinion for alternative management for the problems.

From discussion with individual villages, participation watershed management was proposed. From 65 villagers in Ban Khlong Salao, 60 of them had the same opinion for alternative management for the problems.

From discussion with individual villages, participation watershed management was proposed. From 246 villagers in the watershed area, 220 of them had the same opinion for alternative management for the problems. The outcome was 75 alternative managements. For instance, the alternative way to solve the forest invasion was setting the separate zone between forest and agriculture. Most villagers were aware of the necessary in development and problem solving among the villages, so they gave their point of view for the watershed management. Due to the close relationship between the villages, their opinion for each issue was in the same direction. Normally, the idea of the villages would mainly depend on the idea of the leader. Therefore, the leader should have knowledge and understanding in the situation and problem management in order to transfer them to the villagers.

2.2.2 Public hearing

From the most important situations and problems in the watershed (Table 11), 19 public hearings were arranged which 13 of them were set among subgroups, 5 public hearings were arranged for the local and 1 one the whole watershed. Situations and problems in 12 issues for the local and 15 issues for the whole watershed were considered in the public hearing.

1) Public hearing in subgroups

Thirteen (13) public hearings were set for the subgroups to create and develop the participation for the problem solving in society, economics and environment. Ban Khlong Salao, Ban Tai, Ban Mai Khlong Ungwa 2, Ban Mai Khlong Ungwa 1 and Ban Yang Daeng have public hearing in subgroup to 4, 2, 3, 2 and 2 groups, respectively. Alternative from each group of community was the same result.

2) Public hearing for the whole village

Five public hearings were arranged for the local to create and develop the participation for the problem solving in social, economics and environment.

The detail was considered in public hearing for the whole villages and within subgroup are similar.

3) Public hearing for the whole watershed

One public hearing was arranged for the whole watershed. There were 246 attendants. 15 situations were considered to find the solutions for the problems in society, economics and environment.

Every public hearing provided the alternative way in process development. 75 alternative ways were selected as shown in Appendix table1.

2.2.3 Workshop training

Workshop training was arranged for 130 villagers to gain the opinion for the participation watershed management.

Ban Yang Daeng, Ban Mai Khlong Ungwa 1, Ban Mai Khlong Ungwa 2, Ban Tai and Ban Khlong Salao was arranged to gain the opinion for the participation watershed management for 14, 22, 40, 20 and 34 villagers and the same opinion of them was 12, 18, 32, 18 and 28 villages, respectively. Alternative from each group of community was the same result.

2.2.4 Field trip

Field trip was set for 65 villagers to gain the alternative way for the participation watershed management.

Ban Yang Daeng, Ban Mai Khlong Ungwa 1, Ban Mai Khlong Ungwa 2, Ban Tai and Ban Khlong Salao was arranged to gain the opinion for the participation watershed management for 7, 11, 20, 10 and 17 villagers and the same opinion of them was 6, 9, 18, 9 and 15 villages respectively. Alternative from each group of community was the same result.

From above processes, 75 alternative ways from 300 were derived in the same pattern. Only on alternative way would be used for each situation.

3. Alternative analysis in the watershed by watershed participation management

3.1 Alternatives for watershed participation management

From 75 alternative ways, 60 of them were for the local community level and the other 15 of them for the watershed level. There were 2 main types of the alternative ways which 37 alternative ways were for the development and 38 alternative ways for the problem solutions.

3.1.1 Alternatives for development

The main objective of the alternative way was the proper management for the sustainability.

The most dominant management alternative in each part was 6 out of 37 as below:

1) Alternative social development in Ban Yang Daeng

The most dominant social alternative in community level was culture strict development alternative. The objective was to conserved culture.

2) Alternative economic development in Ban Mai Khlong Ungwa 1

The most dominant economic alternative at community level was stable career development alternative. The objective was made various careers in community.

3) Alternative environment development (soil resource) in Ban Mai Khlong Ungwa 2

The most dominant environment alternative (soil resource) in community level was plain land development alternative. The objective was to use the land according to its potential.

4) Alternative environment development (water resource) in Ban Tai

The most dominant environment alternative (water resource) at community level was optimized water yield in Huai Mae Di dam development alternative. The objective was increased dam potential.

5) Alternative environment development (forest resource), Ban Khlong Salao

The most dominant environment alternative (forest resource) at community level was integrated forest development alternative. The objective was conserved abundant forest.

6) Alternative environment development (wildlife resource), for the whole watershed.

The most dominant environment alternative (wildlife resource) at watershed level was various wildlife development alternatives. The object was reserved wildlife.

3.1.2 Alternatives for problem solving

The main objective of the alternative way was to manage the improper condition of the watershed.

The most dominant in each part total 6 out of 38 ways of problem solving alternative as below:

1) Problem solving in economics of Ban Bang Daeng.

The most dominant alternative in economics community level was short age single cropping for trade solving alternative. The objective was to stabilize career.

2) Problem solving in environment (soil resource) of Ban Mai Khlong Ungwa 1.

The most dominant alternative in environment (soil resource) community level was steep slope land use solving alternative. The objective was to control erosion.

3) Problem solving in social management of Ban Mai Khlong Ungwa 2.

The most dominant social management alternative at community level was culture interfere solving alternative. The objective was to reserved culture.

4) Problem solving in environment (wildlife resource) of Ban Tai.

The most dominant environment alternative (wildlife resource) community level was wildlife hunted solving alternative. The objective was to reward hunting career.

5) Problem solving in environment (water resource) of Ban Khlong SaLao.

The most dominant environment alternative (water resource) at community level was stream bank solving alternative. The objective was to restore stream bank.

6) Problem solving in environment (forest resource) for the whole watershed.

The most dominant environment management alternative (forest resource) at watershed level was encroaching forest and change into cultivate land solving alternative. The landuse was conducted as watershed management objective.

3.2 Test for participation watershed management alternative.

Each alternative way had been analyzed in 4 issues. Therefore, the total results were 300 values of 75 alternative ways but only action values were considered once per year for 4 years. The results of the first alternative way (culture strict development in Ban Yang Daeng) was 90, 92, 95 and 95%, respectively. The result of other alternatives was shown on appendix table 1.

For each year, all 75 participatory watershed management alternatives had an effect on the balance in the watershed. The most distinctive management alternative in the Huai Mae Di Noi watershed was solving for the forest invasion problem by identifying the zones of forest and agricultural area. The results revealed that the agricultural zone connected to the forest was 60 kilometers in consecutive with various villages. It was 57% or 34 kilometers success in the first year, 58% or 35 kilometers in the second year, 63 % or 38 kilometers and 80 % or 48 kilometers in the fourth year, respectively. It was obvious that the watershed management was developed.

Test for 75 participatory watershed management alternatives were based on the process in figure 10 cover in 4 years. The result of every alternative was recorded one time per year and the conclusions of alternative testing in 4 years are:

3.2.1 The first year result (2005)

From 75 alternative ways, the result in the first year was 54.13 %.

3.2.2 The second year result (2006)

From 75 alternative ways, the result in the second year was 57.51 %.

3.2.3 The third year result (2007)

From 75 alternative ways, the result in the third year was 58.79 %.

3.2.4 The fourth year result (2008)

From 75 alternative ways, the result in the first year was 67.16 %.

The detail of the alternative testing was shown on table 15-18.

Testing the participatory watershed management alternative showed that the management value was better with 85.83, 70.63, 60.00, 56.67, 63.13 % value in Ban Yang Daeng, Ban Mai Khlong Ungwa 1, Bang Mai Khlong Ungwa 2, Ban Tai, and Ban Khlong Salao, respectively. The success value of the whole watershed was 67.16 % (Table 19).

3.3 The extension of the alternative ways in participation watershed management.

Participatory watershed management was extended to various communities throughout Thailand. Natural resource and environmental management had been improved.

Table 15 Testing alternatives to participatory watershed management (First year in 2005)

NO.	Indicator	Alternative result (%)					(Watershed)
		Ban Yang Daeng	Ban Mai Khlong Ungwa 1	Ban Mai Khlong Ungwa 2	Ban Tai	Ban Khlong Salao	
1.	Social	85	60	50	55	60	65.75
2.	Economic	82.5	42.5	40	35	45	48.25
3.	Environment	71.25	59.38	38.13	41.88	45	49.63
3.1	Soil	70	50	30	35	55	43
3.2	Water	65	60	35	30	37.5	45.5
3.3	Forest	80	70	35	47.5	52.5	56
3.4	Wildlife	70	57.5	52.5	55	35	54
	Total	79.58	53.96	47.58	43.83	50	54.54

Note. Indicator detail:

- Social: culture reserve and happiness of community
- Economic: efficiency economy of life
- Environment divides to 4 kinds
 - Soil resource: land use base on agreement of community, government and researcher. Fertilize of soil
 - Water resource: Suitable in distribute of water, use water in principle of water conservation
 - Forest resource: do not encroach forest land
 - Wildlife resource: do not hunt every kind of wildlife.

Alternatives detail: (Appendix Table 1)

Table 16 Testing alternatives to participatory watershed management (Second year in 2006)

NO.	Indicator	Alternative result (%)					(Watershed)
		Ban Yang Daeng	Ban Mai Khlong Ungwa 1	Ban Mai Khlong Ungwa 2	Ban Tai	Ban Khlong Salao	
1.	Social	85.0	71.5	50.0	47.5	65.0	66.0
2.	Economic	81.0	47.5	44.0	40.0	45.0	51.25
3.	Environment	76.0	66.25	47.58	44.0	51.0	55.38
3.1	Soil	73.0	47.5	42.5	41.0	57.5	47.0
3.2	Water	70.0	72.5	45.0	40.0	47.5	54.0
3.3	Forest	83.5	80.0	45.0	47.5	45.0	59.0
3.4	Wildlife	77.5	65.0	62.5	47.5	54.0	61.5
	Total	80.67	61.75	47.58	43.83	53.67	54.54

Table 17 Testing alternatives to participatory watershed management (Third year in 2007)

NO.	Indicator	Alternative result (%)					(Watershed)
		Ban Yang Daeng	Ban Mai Khlong Ungwa 1	Ban Mai Khlong Ungwa 2	Ban Tai	Ban Khlong Salao	
1.	Social	90.0	75.0	50.0	45.0	55.0	67.75
2.	Economic	80.0	50.0	45.0	40.0	45.0	51.0
3.	Environment	80.0	71.25	52.5	47.5	53.75	59.5
3.1	Soil	75.0	50.0	50.0	41.0	65.0	52.5
3.2	Water	75.0	75.0	40.0	40.0	45.0	56.0
3.3	Forest	90.0	85.0	50.0	47.5	50.0	63.5
3.4	Wildlife	80.0	75.0	70.0	47.5	55.0	66.0
	Total	83.33	65.42	49.17	44.17	51.25	66.71

Table 18 Testing alternatives to participatory watershed management (Fourth year in 2008)

NO.	Indicator	Alternative result (%)					(Watershed)
		Ban Yang Daeng	Ban Mai Khlong Ungwa 1	Ban Mai Khlong Ungwa 2	Ban Tai	Ban Khlong Salao	
1.	Social	92.5	80.0	62.5	57.5	70.0	77.0
2.	Economic	80.0	55.0	55.0	55.0	55.0	55.0
3.	Environment	85.0	76.88	62.5	57.5	64.38	68.13
3.1	Soil	77.5	55.0	57.5	47.5	70.0	58.0
3.2	Water	82.5	77.5	55.0	60.0	55.0	66.0
3.3	Forest	92.5	87.5	62.5	57.5	70.0	74.0
3.4	Wildlife	87.5	87.5	75.0	65.0	62.5	74.5
	Total	85.83	70.63	60.0	56.67	63.13	66.71

Table 19 Testing alternatives to participatory watershed management from 2005 to 2008

No.	Village	Participation Percentile in 4 years				Changing and development result	Note.
		(2005)	(2006)	(2007)	(2008)		
1.	Ban Yang Daeng	79.58	80.67	83.33	85.83	People's participation was increased	
2.	Ban Mai Khlong Ungwa 1	53.96	61.75	65.42	70.63	People's participation was increased	
3.	Ban Mai Khlong Ungwa 2	42.71	47.58	49.17	60.00	People's participation was increased	
4.	Ban Tai	43.96	43.83	44.17	56.67	People's participation was increased	
5.	Ban Khlong Salao	50.00	53.67	51.25	63.13	People's participation was increased	
6.	(Watershed)	54.54	57.54	59.42	66.71	People's participation was increased	
	Total	54.13	57.51	58.79	67.16		

CONCLUSION AND RECOMMENDATIONS

Conclusion

This chapter described the watershed situation and problem, elaborated the participatory problem solving process and analysed watershed management alternatives. Watershed's situation and problems have been categorized into positive situation and negative situation. Positive situations which contribute to the easy lifestyle, abundant of natural resource and happiness for generations. The main problem was resource usage without conservation for instance land invasion for agricultural area. There were no management correspond to the problems, so participation process was developed by analyzing the situation both in positive and negative ways within 5 villages and the watershed. The situation and problems analysis revealed that the irregular working of the responsible government office and lacking co-ordination affected on the uncertainty in the area and land usage of the villagers. Therefore they invaded the forest area, hunted the wildlife and imitating the way of lives from the low land area. Moreover, there were conflicts between villagers, inappropriate behaviors such as drinking alcohol and quarrelling.

Participation process found that social condition in 5 communities has been changed. At first, the villagers had cooperation and no fighting. There was travelling between the villages without using car so they can meet and rest for a long time. During 2003-2004, price of agricultural product increased, the villagers could buy motorcycle as it is a new thing for the villages. This caused an accident and unexpected result in relationship between the communities. Social activities can conserve various resources as these activities related to the nature both in direct and indirect way are passed on by each generation and mixed with Buddhism. The sustainability of culture in Karen hill tribe relates to Buddhism. Many ceremonies depend on faith and strength of religion.

In problem solving by participation development, four processes which were discussion, public hearing, training and field trip had been arranged in order to consider the situations and problems in the watershed area. From discussion with individual villages 246 villagers in the watershed area, 220 of them had the same opinion for alternative management for the problems. Public hearings were arranged which 13 of them were set among subgroups, 5 public hearings were arranged for the local and 1 one the whole watershed. Situations and problems in 12 issues for the local and 15 issues for the whole watershed were considered in the public hearing. Workshop training was arranged for 130 villagers to gain the opinion for the participation watershed management. Ban Yang Daeng, Ban Mai Khlong Ungwa 1, Ban Mai Khlong Ungwa 2, Ban Tai and Ban Khlong Salao was arranged to gain the opinion for the participation watershed management for 14, 22, 40, 20 and 34 villagers and the same opinion of them was 12, 18, 32, 18 and 28 villages respectively. Alternative from each group of community was the same result. Field trip was set for 65 villagers to gain the alternative way for the participation watershed management. Ban Yang Daeng, Ban Mai Khlong Ungwa 1, Ban Mai Khlong Ungwa 2, Ban Tai and Ban Khlong Salao was arranged to gain the opinion for the participation watershed management for 7, 11, 20, 10 and 17 villagers and the same opinion of them was 6, 9, 18, 9 and 15 villagers respectively. Alternative from each group of community was the same result. From total processes, 75 alternative ways from 300 were derived in the same pattern. Only on alternative way would be used for each situation. Alternatives for watershed participation management were 2 main types of the alternative ways which 37 were for the development and 38 for the problem solutions.

The total results were 300 values of 75 alternative ways but only action values were considered once per year for 4 years. For each year all 75 participatory watershed management alternative had an effect on the balance in the watershed. It was obvious that the watershed management was developed. Testing the participatory watershed management alternative showed that the management value was better with 85.83, 70.63, 60.00, 56.67, 63.13 % value in Ban Yang Daeng, Ban Mai Khlong Ungwa 1, Bang Mai Khlong Ungwa 2, Ban Tai and Ban Khlong Salao, respectively. The success value of the whole watershed was 67.16 %. Participatory watershed management was extended to various communities throughout Thailand.

Recommendations

The recommendations of participation watershed management in Huai Mae Di Noi, Ban Rai district, Uthai Thani province were classified into 3 categories: participation process establishment, research and watershed management policy.

Participation process establishment recommendations.

1. Provide officers to coordinate in participation process.
2. Identify the area for participation process.
3. Consider the representatives of the village in order to prepare them for participation process.
4. Study the area in physic, biology and society.
5. Arrange the activities.
6. Plan the activity period.
7. Develop skill of the villagers by continued activities.
8. Extend the activities to nearby villages.
9. Set local organization to arrange the activities.
10. Establish the organization network.
11. Manage the watershed effectively.
12. Transfer all knowledge and skill of the process to the next coordinator.
13. New coordinator should work with the villagers to continue the knowledge and old coordinator should work as the supervisor and mitigate the result.
14. Adjust and integrate the management according to the appropriation.

Research recommendations

1. Researches in different area should be carried out in order to compare village's behavior.
2. Organization role in watershed management should be studied.
3. Knowledge transfer should be researched for sustainable management.
4. The research should be applied to other areas.
5. Watershed management in culture and tradition should be studied in depth.

Watershed management policy recommendations

1. Policy related to villages' problem and need should be flexibly set.
2. Network all over Thailand should be established for the upstream village.
3. Policy should be assigned the clear aims in social, economical and environmental management.
4. Policy for area zoning should be set to reserve the upstream watershed.
5. Policy in result assessment on natural and environmental management for related organization should be set.
6. Policy in community's role in upstream, middle and downstream should be clearly set.
7. Policy in preventing the intrusion in the watershed should be set.
8. National organization in watershed management should be established.
9. Watershed management should base on the cooperation between communities and government.

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APPENDIX

The keyman in the study area

1. Old man in community 3 persons/community total 15 persons
2. Formal leader of community total 22 persons
3. Former community leader 3 persons
4. Custom and culture leader in community total 5 persons
5. 3 monks from temple in watershed
6. 3 monks who understanding about Huai Mae Di Noi Watershed and community
7. Former officer i.e.
 - 7.1 Formal sheriff of Amphoe Ban Rai 1 person
 - 7.2 Soldier 3 persons
 - 7.3 Officer of Uthai Thani tribe support and develop center 1 person
 - 7.4 Forester from Ban Rai Forest office 1 person
 - 7.5 Teacher 1 person
 - 7.6 The chief of Huai Kha Kheang Wildlife Sanctuary in the past 1 person
 - 7.7 Officer of Huai Kha Kheang Wildlife Sanctuary in the past 1 person
 - 7.8 Forest ranger of Huai Kha Kheang Wildlife Sanctuary in the past 2 persons
 - 7.9 Volunteer people of Amphoe Ban Rai in the past 3 persons
8. Officer from 14 office total 33 persons
 - 8.1 Director of Ban Mai Klong Ungwa school, Ban Klong Salao School, Ban E-Mad E-Thrai school and the teacher of each school 1 person/school total 6 persons
 - 8.2 Leader of Tambon Kan Makrood Public Health office, Leader of Ban Mai Klong Ungwa Public Health office and officer of each office total 4 persons
 - 8.3 Kan Makrood development person 1 person
 - 8.4 Agricultural official 2 persons
 - 8.5 Forest officer from: Uthai Thani Forest office, Huai Kha Keang Wildlife sanctuary (2 persons), Forest Protect Unit Uth. (Nongpreu), Forest Protect Unit UTh. 10 (Thonglang), Forest Fire Control Unit Uth. 2 (Ban Rai) and Huai Kha Keang Wildlife Conservation Intension and develop Station total 7 persons

- 8.6 Officer from Uthai Thani tribe support and develop center 1 person
- 8.7 Malaria officer Tambon Kan Makrood 2 persons
- 8.8 Officer of Agriculture and cooperation bank 1 person
- 8.9 Huai Mae Di Noi soldier 2 persons
- 8.10 Police from Ban Rai police station 2 persons
- 8.11 Officer from Uthai Thani Natural Resource and Environment Office 1 person
- 8.12 Officer from Ban Rai Non-Formal Education Center 1 person
- 8.13 Officer from Uthai Thani Irrigation Project 1 person
- 8.14 Sheriff of Amphoe Ban Rai and deputy 2 persons
- 9. Other group who have experience in Huai Mae Di Noi Watershed total 7 persons
- 10. People in watershed total 125 persons

Sources of secondary data in this study

Collecting secondary data from :

1. Uthai Thani Tribe Support and Develop Center
2. Ban Rai Public Health office
3. Administration Protect Area Office 12 (Nakhon Sawan)
4. Amphoe Ban Rai office
5. Ban Rai Agricultural office
6. Research in the past
7. Others

Participatory observation

The staff conducting participatory observation are 27 persons consisting of one researcher with two assistance, 15 honest persons in 5 communities, 3 monks and 6 government officials in the field.

Appendix Table 1 Testing participatory watershed management alternatives

No.	Alternative	Type	Objective	Action Site	Participation of villager, %			
					Year 1 (2005)	Year 2 (2006)	Year 3 (2007)	Year 4 (2008)
1	Culture strict Development	Social / Develop	- To conserve culture	Ban Yang Daeng	90	92	95	95
2	Teenage negative behavior	Social / Solving	- To succeed culture into new generation	Ban Yang Daeng	80	78	85	90
3	Easy and happiness living development	Economic / Develop	- To conserve lifestyle origin	Ban Yang Daeng	85	87	90	90
4	Short age single cropping for trade solving	Economic / Solving	- To stabilize in career	Ban Yang Daeng	80	75	70	70
5	Rotation cultivation land use development	Soil / Develop	- To reserve ancient land use	Ban Yang Daeng	85	89	90	90
6	Disagreement in rotation cultivation land use solving	Soil / Solving	- To broadcast original knowledge	Ban Yang Daeng	55	57	60	65
7	Complete forest area and stream development	Water / Develop	- To manage stream for community happiness healthy	Ban Yang Daeng	70	75	80	85

Appendix Table 1 (Continued)

No.	Alternative	Type	Objective	Action Site	Participation of villager, %			
					Year 1 (2005)	Year 2 (2006)	Year 3 (2007)	Year 4 (2008)
8	Mismanagement in water resource solving	Water / Solving	- To make water management process	Ban Yang Daeng	60	65	70	80
9	Forest and biodiversity for community living development	Forest / Develop	- To conserve complete forest	Ban Yang Daeng	90	95	100	100
10	Disagreement in forest resource manage process solving	Forest / Solving	- To forest manage by local community	Ban Yang Daeng	70	72	80	85
11	Various wildlife Development	Wildlife / Develop	- To reserve wildlife	Ban Yang Daeng	65	70	70	75
12	Small wildlife hunted Solving	Wildlife / Solving	- To reward hunting career	Ban Yang Daeng	75	85	90	90
13	Culture strict Development	Social / Develop	- To conserve culture	Ban Mai Khlong Ungwa 1	60	75	80	85
14	Bad behavior copy solving	Social / Solving	- To keep culture	Ban Mai Khlong Ungwa 1	60	68	70	75
15	Stable career development	Economic / Develop	- To make various career in community	Ban Mai Khlong Ungwa 1	45	50	50	60

Appendix Table 1 (Continued)

No.	Alternative	Type	Objective	Action Site	Participation of villager, %			
					Year 1 (2005)	Year 2 (2006)	Year 3 (2007)	Year 4 (2008)
16	Browbeat the crop trade solving	Economic / Solving	- To make up local people living	Ban Mai Khlong Ungwa 1	40	45	50	50
17	Fertilizer land near community development	Soil / Develop	- To reserve Soil	Ban Mai Khlong Ungwa 1	60	50	50	55
18	Steep slope land use solving	Soil / Solving	- To control erosion	Ban Mai Khlong Ungwa 1	40	45	50	55
19	The part of Huai Mae Di Noi that complete stream development	Water / Develop	- To conserve stream	Ban Mai Khlong Ungwa 1	60	75	80	85
20	Chemical substance flow to stream solving	Water / Solving	- To conserve stream	Ban Mai Khlong Ungwa 1	60	70	70	70
21	complete forest and pretty view development	Forest / Develop	- To conserve complete forest	Ban Mai Khlong Ungwa 1	70	85	90	95
22	Encroach forest and change into cultivate land solving	Forest / Solving	- To plan land use	Ban Mai Khlong Ungwa 1	70	75	80	80

Appendix Table 1 (Continued)

No.	Alternative	Type	Objective	Action Site	Participation of villager, %			
					Year 1 (2005)	Year 2 (2006)	Year 3 (2007)	Year 4 (2008)
23	Various wildlife Development	Wildlife / Develop	- To reserve Wildlife	Ban Mai Khlong Ungwa 1	60	70	80	85
24	Wildlife hunted solving	Wildlife / Solving	- To reward hunting Career	Ban Mai Khlong Ungwa 1	55	60	70	90
25	Various community action development	Social / Develop	- To make dominant group	Ban Mai Khlong Ungwa 2	50	60	60	70
26	Culture interfered Solving	Social / Solving	- To reserve culture	Ban Mai Khlong Ungwa 2	50	40	40	55
27	Crop development for trade	Economic / Develop	- To increase social help	Ban Mai Khlong Ungwa 2	45	50	50	60
28	Browbeat the crop trade solving	Economic / Solving	- To make up local people living	Ban Mai Khlong Ungwa 2	35	38	40	50
29	Plain land development	Soil / Develop	- To land use follow potential	Ban Mai Khlong Ungwa 2	40	50	60	65
30	Wrong land use solving	Soil / Solving	- To land use follow potential	Ban Mai Khlong Ungwa 2	20	35	40	50

Appendix Table 1 (Continued)

No.	Alternative	Type	Objective	Action Site	Participation of villager, %			
					Year 1 (2005)	Year 2 (2006)	Year 3 (2007)	Year 4 (2008)
31	Irrigation system in area development	Water / Develop	- To administrated water for clear	Ban Mai Khlong Ungwa 2	30	45	35	50
32	Mismanagement water resource solving	Water / Solving	- To established water group management	Ban Mai Khlong Ungwa 2	40	45	45	60
33	complete forest development	Forest / Develop	- To conserve complete forest	Ban Mai Khlong Ungwa 2	30	45	50	65
34	Encroach forest and change into cultivate land solving	Forest / Solving	- To clarify in land use	Ban Mai Khlong Ungwa 2	40	45	50	60
35	Various wildlife Development	Wildlife / Develop	- To reserve Wildlife	Ban Mai Khlong Ungwa 2	45	50	60	70
36	Wildlife hunted solving	Wildlife / Solving	- To make conscious on local people	Ban Mai Khlong Ungwa 2	60	75	80	80
37	Group strength development	Social / Develop	- To increase community potential	Ban Tai	70	75	70	65

Appendix Table 1 (Continued)

No.	Alternative	Type	Objective	Action Site	Participation of villager, %			
					Year 1 (2005)	Year 2 (2006)	Year 3 (2007)	Year 4 (2008)
38	Thinking overpowered solving	Social / Solving	- Thinking and altitude developed	Ban Tai	40	20	20	50
39	Various land use development	Economic / Develop	- Knowledge in soil management transferred	Ban Tai	40	45	50	60
40	Browbeat the crop trade solving	Economic / Solving	- To make up local people living	Ban Tai	30	35	30	50
41	Various land use development	Soil / Develop	- To stabilize in land use	Ban Tai	40	50	55	60
42	Encroaching other community land solving	Soil / Solving	- To clarify in land use	Ban Tai	30	32	35	35
43	Water yield in Huai Mae Di Dam development	Water / Develop	- To increase dam potential	Ban Tai	40	55	60	70

Appendix Table 1 (Continued)

No.	Alternative	Type	Objective	Action Site	Participation of villager, %			
					Year 1 (2005)	Year 2 (2006)	Year 3 (2007)	Year 4 (2008)
44	Mismanagement water in dam solving	Water / Solving	- To establish water group management	Ban Tai	20	25	30	50
45	complete forest development	Forest / Develop	- To conserve complete forest	Ban Tai	40	45	45	60
46	Encroaching other community land solving	Forest / Solving	- To solve land use problem	Ban Tai	45	50	55	55
47	Various wildlife Development	Wildlife / Develop	- To reserve Wildlife	Ban Tai	50	55	60	80
48	Wildlife hunted Solving	Wildlife / Solving	- To stop hunting Career	Ban Tai	60	40	40	50
49	Community harmonious development	Social / Develop	- To make community power	Ban Khlong Salao	60	68	70	80
50	Thinking overpowered solving	Social / Solving	- Thinking and altitude developed	Ban Khlong Salao	60	62	40	60

Appendix Table 1 (Continued)

No.	Alternative	Type	Objective	Action Site	Participation of villager, %			
					Year 1 (2005)	Year 2 (2006)	Year 3 (2007)	Year 4 (2008)
51	Wide cultivate area development	Economic / Develop	- To clarify land use	Ban Khlong Salao	50	55	60	60
52	Browbeat the crop trade solving	Economic / Solving	- To make up local people living	Ban Khlong Salao	40	35	30	50
53	Soil fertilizer development	Soil / Develop	- To land use base on potential	Ban Khlong Salao	50	55	60	70
54	Cultivate area was encroached from other community solving	Soil / Solving	- To make for land use	Ban Khlong Salao	60	60	70	70
55	Water yield and stream development	Water/ Develop	- To conserve stream	Ban Khlong Salao	35	40	40	50
56	stream bank solving	Water / Solving	- To repair stream Bank	Ban Khlong Salao	40	45	50	60
57	complete forest development	Forest / Develop	- To conserve complete forest	Ban Khlong Salao	45	45	50	70

Appendix Table 1 (Continued)

No.	Alternative	Type	Objective	Action Site	Participation of villager, %			
					Year 1 (2005)	Year 2 (2006)	Year 3 (2007)	Year 4 (2008)
58	Encroach forest and change into cultivate land solving	Forest / Solving	- To clarify in land use	Ban Khlong Salao	60	45	50	70
59	Various wildlife Development	Wildlife / Develop	- To reserve Wildlife	Ban Khlong Salao	45	58	50	60
60	Wildlife hunted Solving	Wildlife / Solving	- To reward hunting Career	Ban Khlong Salao	25	50	60	65
61	Culture strict development	Social / Develop	- To reserve culture	Watershed area	75	84	88	90
62	Dark authority cover solving	Social / Solving	- To increase community strength	Watershed area	50	41	30	55
63	Bad behavior copy solving	Social / Solving	- To reserve culture	Watershed area	63	55	65	73

Appendix Table 1 (Continued)

No.	Alternative	Type	Objective	Action Site	Participation of villager, %			
					Year 1 (2005)	Year 2 (2006)	Year 3 (2007)	Year 4 (2008)
64	Wide agricultural land development	Economic / Develop	- To clarify land Use	Watershed area	50	55	60	60
65	Good cropping product development	Economic / Develop	- To promote free trade	Watershed area	45	50	50	60
66	Browbeat the crop trade solving	Economic / Solving	- To improve community potential	Watershed area	36	38	38	50
67	Single crop solving	Economic / Solving	- To stabilize in career	Watershed area	62	62	56	50
68	Soil fertilizer development	Soil / Develop	- To land use base on potential	Watershed area	48	51	56	63
69	Mismanagement in soil resource solving	Soil / Solving	- To land use base on potential	Watershed area	38	43	49	53
70	Stream and Huai Mae Di dam development	Water / Develop	- To conserve water source for sustainability use	Watershed area	47	58	59	68

Appendix Table 1 (Continued)

No.	Alternative	Type	Objective	Action Site	Participation of villager, %			
					Year 1 (2005)	Year 2 (2006)	Year 3 (2007)	Year 4 (2008)
71	Mismanagement water resource	Water / Solving	- To establish water resource management group	Watershed area	44	50	53	64
72	Complete forest development	Forest / Develop	- To conserve complete forest	Watershed area	55	63	67	78
73	Encroach forest and change into cultivate land solving	Forest / Solving	- To clarify in land use	Watershed area	57	55	60	70
74	Various wildlife Development	Wildlife / Develop	- To reserve Wildlife	Watershed area	53	61	64	74
75	Wildlife hunted Solving	Wildlife / Solving	- To stop hunting Career	Watershed area	55	62	68	75
Total				Community and watershed	54.13	57.51	58.79	67.16

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